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SCIENTIFIC AMERICAN

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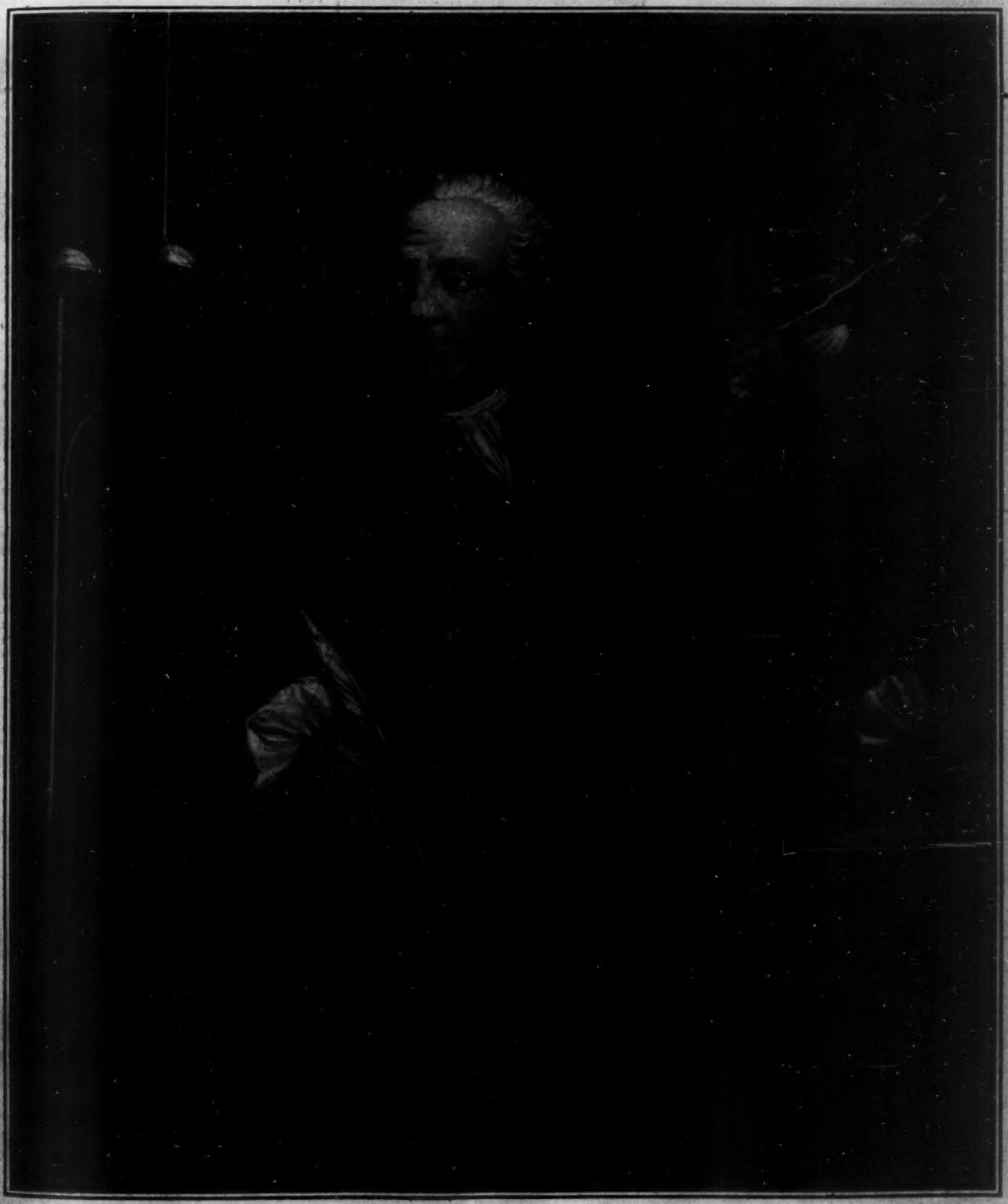

From a mezzotint by E. Fisher, after the Mason Chamberlin portrait.

[See page 320.]

Your affectionate Friend
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B Franklin

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, APRIL 28, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

EARTHQUAKE-PROOF CONSTRUCTION.

In the presence of the awful tragedy which has involved the wiping out of the capital city of the Pacific coast by earthquake and fire, it may seem like a trifling with terms to suggest that, in the rebuilding of San Francisco, it would be possible to render the new city earthquake-proof. In the broadest application of the term, such reconstruction would, of course, be impossible; but after a calm review of such facts as have come to hand regarding the behavior of the various types of construction which have passed through the ordeal, there are certain data which indicate that it will be within the power of the engineer and architect to build a second San Francisco, which, if called upon to do so, could pass through such another seismic disturbance without being completely overturned, or utterly ravaged by fire.

The most hopeful promise for the future is found in the admirable manner in which the steel skeleton of the modern steel-and-masonry building has passed through the terrific shock and wrenching of the earthquake. Although this result has been a matter of surprise to the average layman, it is not so to the engineer. Modern structural steel is possessed of such elasticity and toughness, that it will submit to the most severe and complicated stresses before it can be brought to the point of rupture. Evidence of this may be seen in the case of ships which have been in violent collision, or have been battered for weeks together on a rocky coast, and yet, after temporary patching up, have been brought into drydock for repair, and ultimately restored to first-class condition. Steel cars, which had been bent out of all semblance of their former shape in heavy freight wrecks, have been hauled to the shops and straightened out, to be again put in useful service. So with the skeleton frame of a steel-and-masonry building. If it has been properly designed, and if due attention has been given to the riveted connections at the intersection of the various members, it will stand an astonishing amount of rough usage before total collapse occurs. According to information at present available, it would seem that in buildings of this type at San Francisco, the wreckage directly due to the earthquake was confined to the loosening, and, in some cases, throwing down, of the brick or stone façades with which the buildings were covered in. Probably, also, it will be found that the interior partitions and the floors have, in many cases, suffered a similar fate. The loss of the walls, or paneling, was due to the fact that they were not homogeneous with the steel frame, but were merely attached to it by methods which were never intended to resist the enormous inertia stresses that were set up when the whole building was rocked by the earthquake. Evidently, if this disruption of the walls is to be prevented, they must either be bonded in more completely with the steel frame, or better yet, they must be made homogeneous or monolithic with the frame.

Now the last-named conditions are ideally present in the new form of concrete-steel or armored-concrete construction, which has made such rapid strides of late years in structures of the larger and more important class. As the results of most elaborate engineering tests, concrete steel has been proved to possess in the highest degrees those qualities of elasticity, toughness, and homogeneous strength which, when combined in a monolithic mass, present a structure as nearly earthquake-proof as our present methods and materials can make it. Similarly, and in even greater degree, the buildings of lesser height may be rendered proof against overturning or serious rupture; for the bending and shearing moments introduced by the sudden lateral movements of the earth decrease with the decrease of height.

It will be urged, however, that the earthquake was, after all, only the remote cause of the destruction of San Francisco, which is to be attributed immediately to the rupture of the water mains and the breaking out of simultaneous fires throughout the shaken district. But, on the other hand, it should be noted that if the buildings of the new city, and particularly those in the business portion of it, be built exclusively of armored concrete, with doors and windows of metal or fireproof wood construction, the initial fires would find so little that was combustible to feed upon, that the chances of a general conflagration would be very remote. Moreover, the ability of the Fire Department to cope with such local outbreaks would be greatly assisted by an elaborate provision of an independent fire-service tank, of extra large capacity, at the top of every building. It may be taken for granted that no system of underground water mains will be able to withstand an earthquake shock of this magnitude. Therefore, all measures that are devised for the future protection of the city should include as an indispensable feature the provision of an independent water supply for each building. If the new city be built of absolutely fireproof construction, this system of local water supply should prove equal to any emergency.

As regards the residential and suburban districts of San Francisco, which as we write are being steadily swallowed up by the ever-increasing circle of conflagration, it would be advisable, for similar reasons, to build the hotels, apartment houses, and more pretentious private residences of reinforced concrete. This could be done for the same, and possibly less, cost than if they were rebuilt in stone or brick (to build them in wood, after the present experience, would be simply suicidal). There is nothing in the nature of concrete construction to prevent the incorporation in such buildings of ample decorative and architectural effects. As regards the more modest suburban homes and cottages of the remoter suburbs, the question of building even these of concrete or concrete-steel will be well worthy of consideration by the municipal authorities. The relative cost of wooden and concrete cottages and villas is, of course, determined largely by local conditions, and depends upon the cost of cement and the availability of sufficient supplies of sand, and stone suitable for crushing. Here, in the East, where lumber is more costly than on the Pacific slope, it has been found that in suburban homes the increased cost of concrete construction runs about 15 or 20 per cent. On the Pacific coast, where lumber is cheaper, the difference would be greater; but should it be decided to rebuild San Francisco on the lines suggested, the enormous market for cement that would be thus afforded, would probably result in a competition that would lead to a considerable lowering of the price.

In any case, it is sincerely hoped that before beginning the reconstruction of San Francisco, the municipal authorities will lay it down as an indispensable condition, that the city must be built with special provision for the recurrence, in their most violent form, of seismic disturbances. First among the building restrictions to be improved should be one prohibiting, at least in the business sections of the city, any but the most approved fireproof construction.

SUBWAY VENTILATION BY AIR VALVES.

The very thorough investigation which the Chief Engineer of the Rapid Transit Commission has been making of the problem of ventilation of the Subway has resulted in his recommendation that a series of louvers, or automatic ventilating valves, be installed in the roof of the Subway. Contrary to the popular impression, based upon last summer's extreme discomfort, it has been established beyond a doubt that the "stuffiness" of the Subway is not due to a lack of purity in the air, which is about as good as that on the street surface, but to the most uncomfortable heat which is developed during the sultry season. This heat cannot be reduced to any appreciable extent by the movement of the trains, for the reason that there is a constant and considerable outflow of heat from the motors of the trains themselves; and this is so great that the limited exchange of air between the Subway and the surface which now goes on is quite inadequate to cope with it. The Chief Engineer, Mr. Rice, has stated to the Commission that to improve materially the conditions, the air must be renewed more frequently than at present throughout the whole Subway, and at the same time, recourse must be had to some method of cooling it. It is recommended that provision be made for exhausting the air at points midway between the stations, thereby causing an inflow of air through the station openings. By this means the freshest air would be found always at the stations, and the iron dust thrown off from the brakes would, much of it, be drawn into the interior and out through the exhaust openings there provided.

The proposed automatic valves, which would be located in the roof of the Subway, would depend for their operation upon the movement of the trains. The greater density of the air in front of a moving train will cause the valve to open automatically, emitting the hot air, and as soon as a train has passed a given valve, the latter will close of itself. The experiments which have been carried on between Columbus Circle and the 66th Street station prove that approximately 20,000 feet of air per minute is discharged through 100 square feet of louvers during the hours of maximum train movement; while from 1 A. M. to 5 A. M., when very few trains are running, only about 5,000 cubic feet per minute is discharged. It is suggested that while, during the busy hours, the train action would be sufficient for ventilation, supplementary means should be provided for introducing fresh air during the night time, when the train action is infrequent. For this purpose it is suggested that fans be installed to operate during the night season, and replace the heated air by the colder air from the outside. It is proposed to install fourteen valve and fan chambers between Brooklyn Bridge and Columbus Circle, and to make them of sufficiently large capacity to serve as exits in case of emergency.

THE "KEARSARGE" DISASTER.

The lamentable disaster which occurred on the battleship "Kearsarge," at the close of target practice, as the result of which seven officers and men were immediately killed, and others are not expected to survive, occurred on the anniversary of a similar accident, which resulted in the loss of thirty lives, on the battleship "Missouri"; and, strange to say, it occurred under very similar conditions. It will be remembered that during target practice on the "Missouri," when the breech of a 12-inch gun was opened, there occurred what is known as a "fire-back"; that is to say, the remaining gases in the bore swept back into the turret, ignited, and set on fire some powder which was in the hoist behind the gun. The burning mass fell down to the handling room, where it ignited other powder bags, and resulted in the terrible loss of life referred to. In the case of the "Kearsarge," whose main battery is in double-deck turrets, with a pair of 13-inch guns in the lower turret, and a pair of 8-inch in the upper turret, it seems that three powder bags were being lowered to the magazine below decks, on the vertical cableway, which forms the ammunition lift. A charge was being drawn from one of the 13-inch guns at the time that this powder was passing through the lower turret. According to a cablegram from Rear-Admiral Evans commanding the Atlantic fleet, it would seem that the accident was probably caused by fused metal from an electric switch, which was short-circuited by accidental contact with a shell-extractor. This metal fell upon the powder as it was passing down the hoist. The canvas bags containing the powder are made of a material which is constructed with a view to its rapid combustion when the charge is fired, and no doubt the canvas quickly caught fire, igniting the charge and producing the disaster.

The "Kearsarge" is one of the older ships of our new navy, whose designs were drawn something over a decade ago; and there is some measure of satisfaction in learning that the improved electric-operating gear in the turrets of our later ships is so constructed that a repetition of this accident would be impossible. The disaster must be considered as one of the penalties that must be paid for the great elaboration of apparatus which has been found necessary for the rapid handling and firing of modern naval ordnance. The presence of electric mechanism in the turret, in close proximity to large charges of powder, constitutes an element of danger, as this accident has so tragically shown. If such accidents are liable to happen during peaceful target practice, it is evident that the risk will be proportionately greater when the turrets are subject to the shock and possible penetration of armor-piercing high-explosive shells. Our naval constructors have paid particular attention to the question of preventing such accidents as have happened to the "Missouri" and the "Kearsarge;" and in the "Louisiana" and "Connecticut" an effective system of automatic fire screens has been installed, which will localize, if it does not entirely prevent, accidental ignition of the powder. There is, in any case, a certain risk involved in passing the unprotected powder bags up and down in close proximity to the breech of the 13-inch guns; and we have no doubt that steps will be immediately taken to thoroughly protect the 8-inch ammunition in its transit through the 13-inch turrets. The subject is of very vital importance to our navy; for, unfortunately, the double turret has been installed on the five large battleships of the "New Jersey" class. The double turret was an experiment which has not by any means proved to be the success that was anticipated. It has been abolished from our latest designs and it is certain it will not be repeated in any of our future ships.

An efficient tool-room is a requisite of a good shop. The machines in this department should be high-class, otherwise their imperfections will be reproduced in the tools. In the larger shops it is the duty of the tool-room not only to see that certain tools are on hand for doing the work, but to see what jigs or other fixtures could be made to cheapen production, and to consider in general the best way to handle any special job.

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

The early evening constellations are shown on our star map. The Great Bear is almost overhead, extending north from the zenith. The map shows how the line of its two brightest stars point out the Pole star below them, and also that the star Zeta, at the bend of the dipper handle, is double—a fact which can easily be seen on a fair night by any clear-sighted observer. The Little Bear is now above and to the right of the Pole, and the Dragon (Draco) makes a wide sweep around it. Its two brightest stars, β and γ, are in the northeast, above the much more brilliant Vega, in the constellation of the Lyre.

Cepheus and the Camelopard, which lie below the Pole, are inconspicuous at best, and Cassiopeia, which is brighter, is now too low to be prominent. Perseus is setting in the northwest, and Auriga, the Charioteer, will soon follow him. The twin stars of Gemini, Castor and Pollux, are a little north of west, and Procyon, the one bright object in the constellation of the Little Dog, is south of them. Above this is the inconspicuous Cancer, marked only by the star cluster known as Praesepe, the Bee-hive. Still higher is the Lion, which has one star of nearly the first magnitude, which bears the letter α and the name of Regulus. The stars β, γ, and δ are all of the second magnitude. The second of them is a fine double, seen with a small telescope.

Below Cancer is the head of Hydra, the sea serpent, which justifies its name by its enormous extent—fully half the breadth of the sky. It contains but one conspicuous star, Alphard, of the second magnitude, which stands very much alone to the south of Leo. Being the brightest star in the constellation, it is given the Greek letter α, the first of that alphabet.

This system of naming stars requires perhaps some explanation. In the early days of astronomy stars were named according to their places in the figure of the constellation in which they lay. Alphard, for example, was known as Cor Hydræ, since it lay where the heart of the sea serpent ought to be. Some of the brightest stars, such as Sirius, Procyon, and Arcturus, and also groups like the Pleiades and Praesepe, received names of their own from the Greeks and Romans. The Arabs added many more such names. Aldebaran, Algol, and Fomalhaut are examples.

When in more recent times the stars came to be studied in greater numbers, these methods of naming them were found to be insufficient. The present system was invented about 1610 by the German astronomer Bayer, who conceived the idea of arranging the stars of each constellation in the order of their brightness, and of designating them by the letters of the Greek alphabet in order. The brightest star in each constellation is therefore called Alpha (α), the next Beta (β), then Gamma (γ), Delta (δ), and so on.

In a few constellations the order followed is not strictly that of brightness. For example, in Ursa Major the first seven letters, α, β, γ, δ, ε, ζ, η, are given to the stars of the Dipper in order, regardless of the fact that δ is much fainter than any of its neighbors.

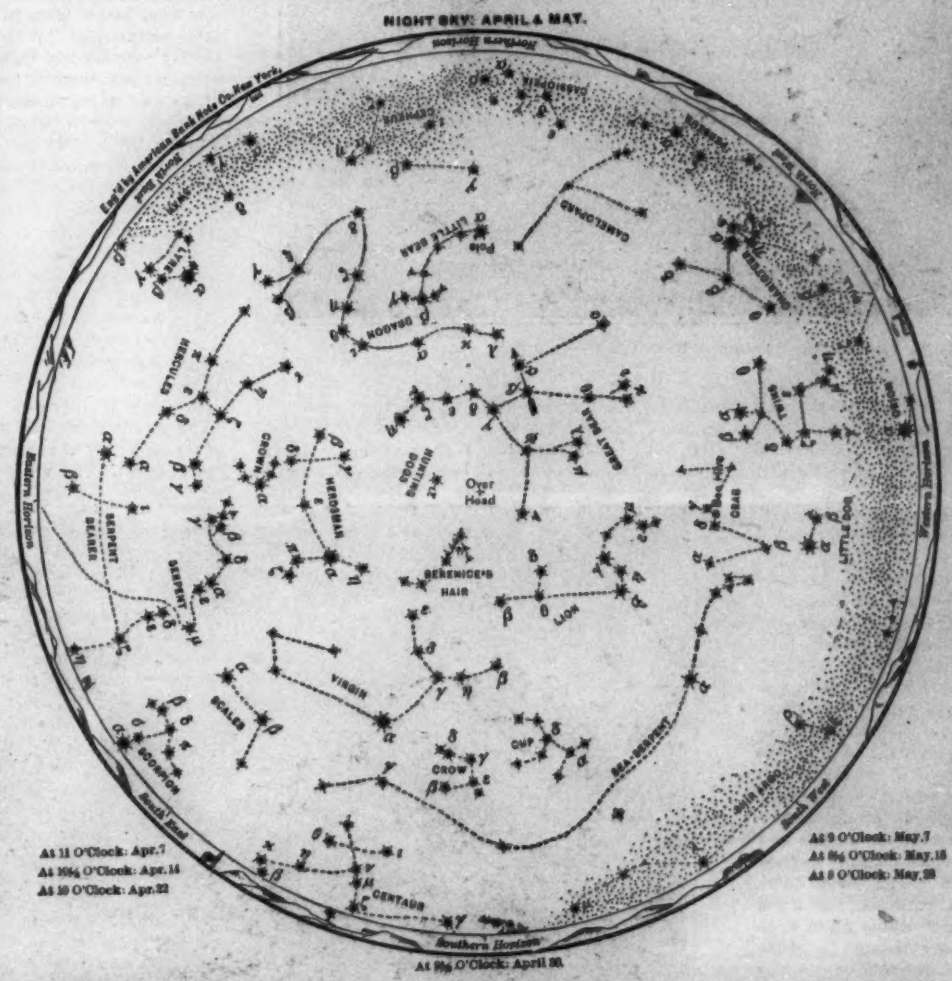
In the larger constellations many stars visible to the naked eye remain after the Greek letters are exhausted. Some of these have the Roman letters a, b, c, etc., but most of them bear numbers, given by the English astronomer Flamsteed toward the beginning of the eighteenth century. Thus we speak of 61 Cygni, and so on.

The telescopic stars are generally known by their numbers in some star catalogue. Thus a certain star of the seventh magnitude in Ursa Major, which according to the most recent observation is probably the nearest in the northern hemisphere, is known as Lalande 21185, since it bears this number in Lalande's catalogue of star places, which was made about a century ago. Sometimes a star may get two or three names in this way, and it takes some little care to recognize it under its various aliases. But this is a matter which troubles only the professional astronomer, and we may turn back from it to the study of the face of the heavens.

On the back of Hydra, due south, are the faint constellation Crater, the cup, and the pretty bright one Corvus, the Crow. Above these is the large and prominent group of Virgo, which has one star of the first magnitude, and several of the third. The star γ in this constellation is also a fine, double one, consisting of two equal components, which revolve about one another in a period of some two hundred years.

Below Virgo in the southeast is the small group of Libra, the Balance (or scales, as it is marked on the map), and still lower is the Scorpion just rising. Due east, and still low, are mingled constellations Serpens and Ophiuchus—the serpent and the serpent bearer—which are so mixed up that they can be better disentangled with the map's aid than by any verbal description.

Above them is Boötes, the Herdsman, with the superb red star Arcturus (α) and several others of the second and third magnitudes. Northeast of it is Corona, the Northern Crown, a beautiful semi-circle which cannot well be mistaken for anything else. Between this and Lyra is Hercules, whose most prominent configuration, shaped like the keystone of an arch, is formed by the four stars η, ζ, ε, and π.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed; counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

THE PLANETS.

Mercury is morning star in Pisces and Aries, and is best seen early in the month, near the date of his greatest elongation, which occurs on the 2d. At this time he rises more than an hour before the sun, and should be easy to see. Toward the end of the month he gets too near the sun to be seen with the naked eye.

Venus, Mars, and Jupiter are all evening stars, and are very close together. They are all moving eastward. Venus goes fastest, and overtakes Mars on the 6th and Jupiter on the 11th, while Mars, which is moving more slowly, overtakes Jupiter on the 18th.

All these conjunctions are close. The one between Mars and Venus is especially remarkable, for the two planets come so near together that they could hardly be separated by the naked eye. This happens at 9 A. M. by our time, so that we cannot observe it, but on the preceding and following evenings their apparent distance will be less than half the moon's diameter.

The conjunctions in which Jupiter takes part are not so close, but both Venus and Mars come within 1¼ degrees of him. All the planets are in Taurus, a few degrees north of Aldebaran, which will afford a fixed point with whose aid we may determine their motions. They set about an hour and a half after the sun, so that it will easily be possible to observe these conjunctions, which are the most interesting celestial phenomena of the month. Saturn is morning star in Aquarius, rising at about 2 A. M. in the middle of the month. Uranus is in Sagittarius, and comes to the meridian at 9 A. M. on the 15th. Neptune is in the western part of Gemini, and sets at about 10:30 P. M.

THE MOON.

First quarter occurs at 2 P. M. on the 1st, full moon at 9 A. M. on the 8th, last quarter at 3 P. M. on the 15th, new moon at 2 A. M. on the 23d, and first quarter once more at 1 A. M. on the 31st.

The moon is nearest us on the 8th, and farthest away on the 22d. She is in conjunction with Uranus on the 11th, Saturn on the 16th, Mercury on the 21st, Jupiter and Mars on the 24th, Venus on the 25th, and Neptune on the 26th.

On the night of May 2 the moon occults the bright star Regulus. As seen from Washington, the star disappears behind the moon's dark limb at 11:42 P. M., and comes out on the opposite limb at 12:33 A. M. The times for observers in other parts of the country will be somewhat different.

THE RELATION BETWEEN PAIN AND INFLAMMATION.

Inflammation and pain are so closely connected that a person who feels pain in the throat often complains of having a sore throat or an inflamed throat without examining the throat to see if it is really inflamed. Hitherto inflammation has been taken as a cause and pain as its inevitable effect, but according to a remarkable investigation by Prof. Spiess, reported in the Münchner Medizinische Wochenschrift (Munich Medical Weekly) for 1906, No. 8, the pain is the cause and the inflammation is the effect.

If the pain is calmed by anæsthetics, the inflammation also subsides. For example, inflammation of the mucous membrane of the nose and throat can be cured by anæsthetics, and if an anæsthetic is injected into an incipient boil, there is little subsequent inflammation. In the treatment of inflammatory diseases, therefore, painlessness is an object well worth striving for. Spiess regards the cessation of the nasal secretion of influenza during sleep as a proof that the inflammation of the mucous membrane is arrested by the insensibility of sleep, and he explains in a similar manner the often observed healing of wounds, without inflammation, in insane persons.

As an anæsthetic Spiess first employed orthoform, afterward novocain, a substitute for cocaine, the poisonous character of which makes it unsuitable for use.

The inflammation following operations on the tonsils, which is ordinarily very severe, was almost wholly prevented by applications of orthoform before and after the operation. The inflammation as well as the pain of wasp stings, mosquito bites and slight wounds was prevented by rubbing them with an aqueous solution of the anæsthetic.

It is too soon to attempt an explanation of these remarkable results. The inflammation appears to be the result of a reflex action transmitted by the sensory nerves. The anæsthetics used should therefore be such as affect those nerves alone, and have no influence on the vasomotor nerves, which regulate the supply of blood.

The New Army Rifle.

A new magazine rifle will be issued to all of the infantry and cavalry troops in the United States before the end of May. The new bayonets have been manufactured, and the Ordnance Department now has on hand a large quantity of the new small arm, which will be immediately issued.

FEELING THE EARTH'S PULSE.

The land on which we live and build our houses—the land, which the sea-writers of the early part of last century confidently and almost affectionately termed *terra firma*—is well nigh restless as the ocean which washes its shores. Even in the north some seventy unfelt earthquakes, each having a duration varying from twenty minutes to several hours, may be recorded yearly. Our buildings rock and sway, if we could but see them, as the masts of a ship on a heaving sea. To be sure, the incessant rising and falling of the waters is more violent than the motion of the land. But the difference between the two is largely a difference of effect—the difference between a billow and a ripple.

General View of the Weather Bureau's Seismograph.

We, who live far north of the equator, never perceive the feeble tremors of the earth beneath our feet. But the man who spends his life in studying the movements of the land, great and small—seismologist he calls himself—knows better.

The seismologist knows that the earth throbs, not because he has better eyes than other people, but because he has devised wonderfully ingenious instruments, so highly sensitive that they tremble as the earth trembles, and thus enable him, as it were, to feel the earth's pulse. And with the help of these delicate instruments, he can tell us how large, or rather how small, are the ripples that play over the earth's surface. Some day when more seismological stations are established throughout the world, when more seismological records have been gathered, and when some master mind will burst forth whose grasp is so broad that it can embrace many isolated scientific facts that now apparently have no connection, we may even know what earthquakes really are and by what they are caused. When that scientific millennium comes, the earthquake-prophet will appear in the land and tell us when and where we may expect the next volcanic eruption or upheaval of the earth.

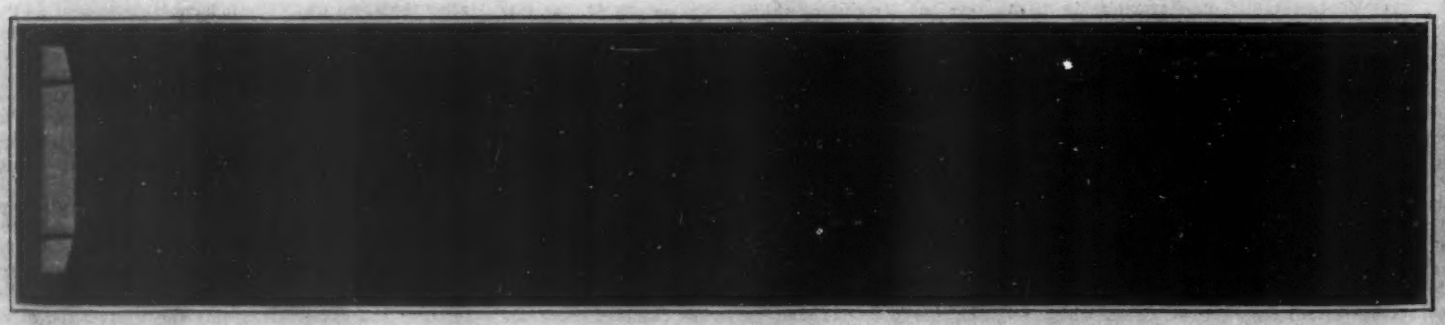
It must be confessed that the theories of the origin of volcanic eruptions and of earthquakes, with which science has so far furnished us, are more picturesque than useful. About one hundred and fifty years ago a Cambridge professor, John Michell, advanced the remarkable theory that the earth's crust constituted but a shell, the interior of which was a liquid body. He thought that this interior liquid was in some inexplicable way lashed into waves, just as a carpet becomes a billowy mass when shaken by one corner; and that such waves shook the earth's crust and produced earthquakes. For a century and more that theory, modified slightly to suit newly-discovered facts, has been paraded in every school and college that professed to teach anything at all of geology. Modern physicists, however, have contumeliously knocked Michell's theory on the head. We are almost ashamed now that we ever believed it. With the fate of Michell's doctrine before them, scientists have been loath to advance new ideas. Nevertheless, an English geologist of note had the courage to believe that earthquakes were due to "the snap and jar occasioned by the sudden and violent rupture of solid rock masses, and perhaps the instantaneous injection into them of intumescent molten matter from beneath." That seems bewildering enough to be true. But the "intumescent molten matter" theory has also been laid at rest. Well aware of the enormous expansive force of steam, some students of earthquakes have not hesitated to attribute such violent eruptions as we have recently witnessed at Vesuvius, to water which has found its way down into the earth and come into contact with highly heated masses of rock. The theory is at least plausible. But it has been sharply assailed by well-informed critics.

After all this indiscriminate theorizing, it must be confessed that but little progress has been made in furnishing an adequate explanation of the origin of earthquakes and volcanic disturbances. Seismologists have succeeded in establishing simply the fact that the occasional displacements of the earth's crust are due to the sliding, crumpling, bending, and cracking of rocks. The origin of such a disturbance may be best described as a wrench, which, when analyzed, is found to consist of a pull and a twist. This wrench both compresses and distorts. It gives rise to two waves—a wave of compression and a wave of distortion—which travel with different velocities. Rock, like most bodies, tends to return to its original volume, after compression, by virtue of its elasticity. To the forcing together and springing apart of the rock molecules is due a wave of longitudinal displacements—one of the two waves mentioned. The rigidity of the rock gives rise to a wave of transverse displacement—the other of the two waves.

If an earthquake be simply the result of wave motion, an inquiring man might ask: How comes it that only certain places experience the shock, and not all those along the line of the wave?

A distinction must be drawn between the movement of the wave and the movement of the molecules of rock through which the wave travels. The pulse of the wave may be propagated to a vast distance; and yet the excursions of the rock molecules are confined within narrow bounds. Imagine a long row of marbles, placed on a table, the one touching the other. If a shock be imparted to the marble at one end of the row, the marble at the opposite end will leap out of its place; but the intermediate marbles will scarcely move at all. The wave was transmitted through its entire row, but only where it broke was the shock felt. Thus is the shore battered by sea-waves; thus is the earth heated by the breaking of light-waves sent by the sun; and thus it happens that such rock-molecules during an earthquake may move only through

Detail of the Stylus and Recording Drum.



Record of San Francisco Earthquake Made by Weather Bureau Seismograph, Showing that the Shock Was Felt at Washington at 8:20 A. M., April 18, 1906.

THE EARTH'S AUTOGRAPH.

a few inches, while the undulation may travel for hundreds of miles. The distance through which the individual molecules oscillate is called the "amplitude" of the wave.

With the effect of a seismical wrench determined, the next step is to invent some means of detecting and recording the waves, felt and unfelt, to which that wrench gives rise. Such means are primarily of importance for the purpose of determining the path of the wave. Naturally, the waves that can be felt are those most easily recorded. Every object that has been visibly affected by a seismic disturbance is a recorder, to a certain extent. Fractures and fissures in walls rent by an earthquake are of inestimable value to the seismologist, because they often indicate the direction in which the waves emerge at the surface and the manner in which they break. The simplest of all recorders, one which has been used in Japan for over twelve hundred years, is a lamp, which, when overthrown, is extinguished. Still another form of recorder, simple as it is rude, consists of a vessel containing some syrup-like liquid, which rocks as the earth rocks, and leaves its mark—a rough indication of the direction and extent of seismic motion. A device much used in Italy comprises a tray, formed in its sides with recesses which are filled to the brim with mercury. When the earth trembles, the mercury is spilled into small cups, hung beneath the recesses. By measuring the amount of mercury retained by the cups,

(Continued on page 346.)

Fig. 4.—Feeder Gallery, Showing Type Coil Circuit Breakers for Feeders and Generators.

ELECTRICAL EQUIPMENT OF THE LONG ISLAND CITY POWER STATION.

In our issue of April 7 we published an illustrated article on the Long Island power station of the Pennsylvania, New York, and Long Island Railroad, which dealt with the building, coal-handling plant, turbines, and generators. In the present article we give some details of the electrical equipment of the installation, which will be of interest.

A somewhat unusual feature has been introduced into this station, to prevent the serious deterioration usually occurring where salt water is used for circulation in surface condensers. It is the universal experience that more or less galvanic action at the expense of condenser tubes takes place in any event, but this is often aggravated in large and important plants by the fact that the water and the body of the condenser have formed a convenient path for stray electric railway return currents getting back to their own power station some distance away through the condenser intake and the water of the harbor. In the case under discussion a sufficient number of voltmeter readings was taken between the river, the flume, and various parts of the piping about the building and in the streets to indicate that there was at all times difference of potential sufficient to make trouble, notwithstanding that its polarity was not always the same.

The metallic connections of the power station equipment to the city piping station are through two 14-inch connections to the water main; and on ac-

Fig. 1.—Booster for Preventing Condenser Electrolysis

Fig. 3.—General View of Bus Gallery, Showing Main Generator Rheostats and Auxiliary Wiring.

Fig. 2.—Electrical Operating Gallery.

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count of the proximity of the water mains to trolley tracks all over the city, there is a tendency for stray currents to flow into the piping of the building, and thus subsequently cause electrolytic corrosion in the condenser tubes. The method adopted to prevent this corrosion consists first in providing a shunt circuit between the incoming water pipes and the condenser flumes, in order to divert as large a proportion as possible of the current from the condensers. Thus, such current as may leak from the pipes to the water contained in them, has an opportunity to return into the harbor water without going through the piping system and the condensers.

In order to neutralize the effect of such current as might still leak past the insulating joints provided, a small booster generator is utilized. This is driven by a 220-volt motor, the positive pole of the booster being connected to the heavy grounded shunt cable above mentioned; the negative pole being connected to seven different points on each condenser. There is an adjustable rheostat in each of these branches of the negative circuit. By means of this superimposed voltage the destructive potentials can be counterbalanced, and the condenser is then in a neutral electric state which effectively prevents corrosion, and secures a far longer life than has hitherto been possible for this very important and highly vulnerable section of the steam equipment. The booster apparatus, shown in Fig. 1, is conveniently situated in the electrical bus gallery directly under the operating gallery.

The generator control bench with the instrument board and adjacent switchboard are illustrated in Fig. 2. The bench resembles a low desk with an inclined top, and accommodates three sets of operating handles for the generator main switches and selecter switches, one set for each unit, and two sets for the bus junction switches, which divide the main bus into sections. The apparatus on each generator panel of this desk consists of the various controllers, three sets of indicating lamps, and two synchronizing receptacles.

Directly opposite each generator panel on the desk is a vertical panel in the generator instrument board, which carries the various measuring instruments, as well as a synchronizing lamp, and a lamp indicating the position of the field rheostat, besides an illuminating visual indicator forming the return signal from the engine room. These instruments are all operated from current derived from shunt potential transformers and series transformers, suitably located in the leads from each machine.

The generator rheostats are mounted in a structural steel framework directly under the operating bench on the second or bus gallery, and are illustrated in Fig. 3. The rheostat proper consists of a series of cast-iron grids set in an iron frame. The face plate is mounted on a marble slab, and the contact arm is operated by means of a little direct-current motor receiving current from the 220-volt auxiliary bus and controlled from an operating handle on the generator panel. Reference to the photograph shows another panel mounted directly above the rheostat face plate, upon which is mounted an electrically-operated main field switch worked from the field switch-controller handle on the generator panel. The brackets supporting the 220-volt exciter and auxiliary buses are mounted on porcelain insulators carried on the steel framework directly over the generator rheostat and directly under the exciter switchboard.

The oil switches of the type used for the feeder circuits are shown in Fig. 4, two of those in the photograph being shown thrown in, while one is shown thrown out. The operation of opening and closing a switch is performed by the action of two separate solenoids, one for each function, situated on top of each switch structure. The larger of the two solenoids draws the switch up into the closed position, where it is held by a trigger, which is tripped by the action of the smaller opening solenoid. The solenoids are energized by 220-volt direct current from the auxiliary bus. The feeder circuit-breakers are fitted with both automatic and independent hand control. The former consists of an A. C. relay, receiving current from a series transformer situated in the feeder, the relay closing the 220-volt circuit across the opening solenoid on top of the breaker. Independent manual control is effected from the main switchboard by simply closing the 220-volt solenoid circuit by a switch that is in parallel with the automatic A. C. relay. All the outgoing feeder and main generator switches are fitted with both kinds of control, but all the selecter switches have manual control only. The indicating lamps for each switch are mounted underneath the bench, and indicate when lighted through different-colored lenses set flush with the top of the bench.

Very important improvements of the North Sea Canal from Amsterdam to the North Sea are in progress, and are expected to be completed in the course of 1907. When finished, the canal will be considerably wider and deeper, and altogether better navigable for the largest class of steamers.

FEELING THE EARTH'S PULSE.

(*Continued from page 345.*)

the intensity of the shock can thus be roughly gaged.

Such recorders are too crude for the modern scientists; they can never reveal those finer perturbations, which play so important a part in the study of earthquakes. For that reason the seismologist has been compelled to devise ingenious self-registering instruments which furnish us with permanent records of tremors, so exceedingly feeble in their effects that the particles of earth-molecules are not displaced more than a very small fraction of an inch in the transmission of the pulse.

The instruments in question are called seismoscopes and seismographs, and may be roughly divided into two classes. In the one class, the earth's motion is translated into diagrams written on stationary plates; and from these diagrams it is possible to ascertain with wonderful accuracy the extent and the direction of the principal vibration in a shock. In the other class, the movement of the earth is recorded on a surface traveling at a known rate; and from the tracing thus made the seismologist can deduce the period or the rapidity with which the earth's undulations follow one another. These latter diagrams are of extreme importance. They are the means of calculating the acceleration or suddenness of movements; in the hands of the engineer they are factors that enable him to erect structures capable of resisting known forces, and not structures simply strong enough to withstand an earthquake. To the man who knows an earthquake merely as a destroyer of towns, the diagrams written by the earth seem a tangled, hieroglyphic script. To the seismologist, they are as unmistakable in their meaning as printed words; they are autographs, as it were, written by the quivering earth at a time of great internal violence.

In order to obtain a complete record of every detail of a seismic disturbance, the movement of the earth, in one of the most approved forms of instrument, is resolved into three components, the one vertical, the other two horizontal, and all at right angles to each other. These three component movements are registered by three distinct pointers on a sheet of smoked glass, which is made to rotate at constant speed by clockwork. A single earthquake always consists of many successive displacements of the ground; hence the mark traced by each pointer on the moving plate is a line comprising many undulations, usually very irregular in character. The amplitude, period, and form of each of these tracings are measured; and by compounding the three the seismologist obtains full information of the direction, extent, velocity, and rate of acceleration of the movement at any epoch in the disturbance.

Instead of using a smoked disk of glass, a drum can be employed, the record being made on a band of smoked paper. The diagram is less difficult to interpret than that of a plate, because it is written on either side of a straight line, and not around a circle. In order to avoid the trouble of handling smoked paper, the diagram is sometimes written along a straight line with a pen or pencil. When the shock has passed, the drum stops. But if a second or third shock should occur, which is often the case, the drum is again automatically set in motion.

In order to record slight earth tremors, an instrument called a tronometer is used. Every five minutes, by clockwork contacts and an induction coil, sparks are discharged from the end of a long pointer, and perforate bands of paper. If the pointer be at rest holes are pierced, following one another in a straight line; but if the pointer be in motion, the bands of paper are perforated in all directions. The earth movements which cause these so-called tremors are apparently long surface undulations of the earth's crust, resembling very much the swell of the ocean. A more satisfactory record of this swell is made by a continuous photograph of a ray of light reflected from a small mirror attached to an extremely light horizontal pendulum.

Electrical seismoscopes are among the most delicate devices yet invented for the measuring of earthquakes. They are of such construction that they cannot be here described for lack of space. So sensitive are they, that the slightest disturbance closes an electric circuit, thereby actuating electro-magnets and liberating the driving mechanism of the recording surfaces on which the earth's signature is written.

In some Japanese observatories the time of an earthquake is recorded by a curious form of clock. When the ground trembles, the dial moves quickly back and forth and receives on its surface three dots from ink pads on the hands. Thus the earth is made to stamp on the dial the exact hour, minute, and second when it trembled.

The list of the instruments might be tediously multiplied. Enough have been mentioned, though, to show through what means our knowledge of the movements of the ground has been increased, and how we are investing earthquakes with a significance which they certainly did not possess for our forefathers.

The seismograph upon which the great San Francisco earthquake was registered at Washington, D. C., belongs to the Weather Bureau. It is installed in a small room and consists of a post having a horizontal pendulum suspended against it near its base by two inclined wires. The plumb line on the other side of the post shows that this stands exactly vertical. Attached to the large weight on the end of the pendulum is a horizontal stylus, which projects over a vertical drum that carries the band of paper. The drum is rotated at a uniform speed by suitable mechanism, and the recording pen traces a straight line upon it. When the vibrations of the earth occur, the pendulum, owing to its inertia and its method of suspension, remains stationary, while the drum carrying the band of paper moves back and forth beneath it. The movement of the earth is thus recorded as a series of oscillations on either side of the straight line which the pen would normally draw. Each band of paper lasts for a period of twenty-four hours and, as the drum is moved slightly along its axis throughout each revolution, twenty-four parallel lines are traced. A suitable electrical apparatus makes dots on the paper at intervals of one minute, so that the time is accurately checked from the observatory.

The record which we reproduce was started at 2:27 P. M. of Tuesday, April 17, about sixteen hours before the earthquake took place. The lines traced by the pen were as straight as usual up to 19 minutes and 50 seconds after 8 A. M. Wednesday. At this point the first vibration in the straightness of the line occurs, and, as can be seen, the oscillations are very slight for the first five minutes. About 8:25 they increased greatly in size for some two and a half minutes, diminishing again for the following two or three minutes, only to increase once more rapidly at 8:30, until, at 8:32, the motion was so great that the paper slipped out from under the recording pen, and the latter failed to make a record for the next three minutes, owing probably to its sticking on the edge of the band of paper. At 8:35 it began once more to record the vibrations, and these gradually diminished in strength until 9:10, when Prof. Marvin, who had charge of the instrument, noticed that the vibrations were increasing again enough to move the paper out of place. He consequently reset the cylinder with the line to continue at a higher level. The vibrations appeared to diminish, with the exception of one or two notable ones that occurred shortly after 9:45, and from then on the line began to resemble its normal appearance.

The record obtained at Washington was supplemented by more complete records made at the United States Coast and Geodetic Survey Observatory, at Cheltenham, Md. At the latter observatory an instrument was located, which registered not only the east and west vibrations, but the north and south ones as well. A complete record of the vibrations in both directions was obtained, and this showed that those in the north and south direction were of greater amplitude, but extended on the whole throughout a lesser period of time, although the individual vibrations were longer in duration. We give below the official statement of the Coast and Geodetic Survey.

"The record from a distant earthquake (one more than six hundred miles away) may conveniently be divided into several portions. The first portion, generally known as the preliminary tremor, consists of very small, irregular vibrations, with a period of two to four seconds. The duration of these preliminary tremors is believed to increase directly with the distance from the origin of the earthquake. Next comes the principal portion of the earthquake, which generally begins with three or four large waves of a period of fifteen to twenty-five seconds. Immediately following these waves come the large waves, generally lasting several minutes and producing the maximum motions of the recording stylus. After this the motion dies down slowly until the end.

"At Cheltenham the preliminary tremors began at 8 hours, 19 minutes, 24 seconds at a distance of 2,450 miles from San Francisco; assuming now the time of the first shock as 5 hours 12 minutes Pacific time, or 8 hours 12 minutes Eastern time, as given by Prof. Davidson, of the University of California, the velocity of these tremors is found to be five and one-half miles per second, about twenty-seven times the velocity of sound. The time taken for these waves to cross the continent was 7 minutes 24 seconds.

"The large waves began about 8 hours 30 minutes 13 seconds, or an interval of 18 minutes 13 seconds after the first shock, and the velocity of these waves appears to be about two and one-quarter miles per second.

"The duration of the earthquake was nearly four hours. The duration of the strongest motion, however, was only from 8 hours 30 minutes to about 8 hours 40 minutes; during this period the motion was too large to be properly recorded by the seismograph.

"The period of vibration in the preliminary tremors

was about two to four seconds; in the principal portion it varied from ten to twenty seconds.

"The San Francisco earthquake, besides being recorded the world over on specially designed earthquake instruments called seismographs, likewise affected the self-recording magnetic instruments at the three magnetic observatories of the Coast and Geodetic Survey thus far heard from.

"At the magnetic observatory at Cheltenham, Md., this disturbance began about half-past eight A. M., Eastern time, on April 18, and continued for about half an hour. This disturbance began some time after the preliminary tremors, coinciding with the principal portion of the disturbance as recorded on the seismograph.

"It affected chiefly the horizontal and vertical components of the earth's magnetic intensity, the greatest disturbance amounting to one one-thousandth part of the horizontal intensity and about one two-thousandth part of the vertical intensity. It was not of the same character as that due to a cosmic magnetic storm or as that recorded in connection with the Mont Pelé eruption, but appears to be chiefly if not entirely mechanical.

"At Baldwin, Kan., where there is no seismograph, the magnetic instruments also recorded a similar disturbance, lasting from twenty-two minutes after eight to half-past eight, Eastern time, some time after the preliminary tremors of the earthquake had reached Cheltenham.

"At the Sitka Observatory this disturbance was also recorded by the magnetic instruments from twenty-four minutes past eight to thirty minutes past eight, Eastern time, somewhat later than the preliminary tremors recorded on the seismograph at this observatory.

"It is to be noticed that in each of these three cases the magnetic disturbance occurs at about the same time that the greatest motion is being recorded on the seismograph.

"The question whether the earthquake disturbed the magnetics in a purely mechanical way or by its action on the earth's magnetism is by no means settled. In fact, it is only recently that attempts have been made to study the phenomena. Up to the present the results are contradictory. At times the magnetic disturbance is simultaneous with or actually precedes the preliminary tremors. In other cases, like the present one, it accompanies the principal portion of the disturbance.

"In some cases of large earthquakes no magnetic effect can be detected and in a few other cases, notably March 21, 1904 (New England earthquake), the shock was recorded at Cheltenham by the magnetic instruments, but was not recorded by the seismograph either at Baltimore or Washington."

SAN FRANCISCO AND ITS CATASTROPHE.

Fortunately it is seldom that one great elemental catastrophe follows close upon the heels of another. Usually Nature seems to stop and draw breath before beginning a further alteration in the epvelope which restrains her greatest forces. The full horror of the devastation which last week swept San Francisco and adjacent cities, burst upon us before we had even fairly concluded that the Neapolitan disaster had reached its full extent. The earthquake which was the ultimate cause of the destruction of the greatest American city on the Pacific coast was incomparably the severest ever recorded in the United States, and was accompanied by the loss of hundreds, if not thousands of lives, and the destruction of property valued at hundreds of millions. But the full extent of the cataclysm was hardly realized until it was found impossible to check the progress of the fires which immediately sprang up at innumerable points among the ruins of collapsed buildings. The earth tremor destroyed almost the entire water system of the city, and the local fire department, as well as the assistance sent from other cities, was practically helpless. Dynamite and even artillery were used without effect to stay the sweep of the flames, and at the present writing San Francisco is the scene of a conflagration which is said to overshadow even the recent great fire of Baltimore, and which has rendered over 300,000 people homeless and helpless. To the terror of fire has been added the suffering entailed by lack of food and water, for railroad communication with the wrecked city has been all but destroyed and even telegraphic connection was not re-established till hours after the first shock.

That the native energy, courage, and resourcefulness of the Californian will raise upon the ashes of San Francisco a greater and more splendid city is certain; nor will the lessons taught by the destruction be lost. As far as can be learned from the meager reports obtainable it appears that solid masonry structures collapsed like so many houses of sand while more modern structures with steel skeletons were damaged to a far slighter extent. If true, this is doubtless because of the elasticity of the riveted framework, while the rigidity of solid masonry was of no avail against the rising and falling of the earth under the foundations. The severest damage due to the shaking of the earth itself was caused in that part of the city that was built on reclaimed land, and it seems that here even modern structures were unable to resist the sinking of the earth.

It would seem that the disaster of San Francisco, following so closely upon the great eruption of Vesuvius, could, in some manner, be traced to an origin at least analogous to that which caused the latter. It is the consensus of opinion, however, of scientific men, that the earthquake on the Pacific coast is of local origin. It is probable that the tremor was due to the slipping or fracturing of some great stratum or of several strata of rock either directly underlying the city or under the Pacific Ocean nearby. That the center of the convulsion was either under the land, or not far from the shore, is shown by the fact that no great annihilating sea wave resulted, like that which made the great earthquake of Lisbon, in 1755, so terribly destructive. On that occasion a great tidal wave passed clear across the Atlantic Ocean in nine and a half hours, and the effect of the shock itself was felt even in England. The Pacific coast which lies in an earthquake belt quite distinct from that which includes Southern Italy is peculiarly susceptible to disturbances of this nature. The present configuration of the soil is of recent geological age, and the coast, unlike the Atlantic shore line, shelves rapidly to deep water, and thus the slipping of rock strata, which is usually the cause of non-volcanic convulsions, is greatly facilitated. It is for the same reason that the Japanese islands and the Asiatic coast are so frequently the scenes of earthquakes, some of which, especially in Japan, have been of terrific intensity. It is quite true that volcanic eruptions and earthquakes are liable to occur simultaneously, but in the case of California a connection should be sought between its earthquakes and the condition of the volcanoes, either along the Pacific coast, or on the groups of volcanic islands in that ocean. In the last great earthquake of 1868, in which San Francisco suffered severely, there appears to have been undoubted connection between the tremor and the intense volcanic outburst in the same year of the Hawaiian volcanos, Kilauea and Mauna Loa, which probably directly caused the strata settling which give rise to the surface movement.

That the earth is extremely sensitive even to the slightest shocks, contractions, or alterations is shown by the tremendous rapidity with which the indications of these are transmitted to various parts of the globe. A few minutes after the first shock was felt in San Francisco the seismographic instruments at Washington recorded the tremor. A tremor of slight intensity would be sufficient to start the rearrangement or readjustment of a poorly balanced or heavily strained mass of strata underlying the earth's crust, and so, while we cannot directly blame Vesuvius for the Californian catastrophe, it is quite possible that an earth wave emanating from the labor of the mountain and traveling for thousands of miles through the solid mass of the crust provided the necessary initial agitation to start the movement of the strata.

Prof. John Milne, the great English seismic authority, has advanced a theory to account for recent disturbances of this character manifested here and abroad in various parts of the world, which has been held tenable by Sir Norman Lockyer and Prof. Archenbold. Prof. Milne declares that the disturbances are due not to a merely normal readjustment of the earth's strata or to the shifting of the surface to meet a gradual contraction in the size of the globe, but are caused by displacement of the globe itself from its true axis and are really due to the jar incident to the subsequent swinging back of the earth upon that true axis. It is conceivable that such a return movement to the axis as well as the original distortion would cause a tremendous strain upon the crust, and could easily account for the most terrific seismic convulsions imaginable. Sir Norman Lockyer declares further that the deviation from the true axis, a fact which, by the way, can be scientifically proven, is due to the great sun spots which at present are sending more energy to the earth than at any other time during the thirty-five years sun-spot period, and which through the great differences in the corresponding temperatures cause the formation of vast ice-masses at one or the other of the poles, of such weight that the distortion takes place, to be subsequently remedied by other variations.

The consideration of the terrible calamity which San Francisco has suffered immediately calls to the mind of the New Yorker the thought of what would happen should a similar disturbance occur on the Atlantic coast. From the experience to be gathered in the present earthquake and from what has been learned on other occasions, it would seem that many of New York's great modern buildings would stand a fair chance of immunity unless the convulsion were one of extraordinary violence, for not only is the great majority of the later structures of the riveted steel-frame type, but the underlying formation, particularly of the island of Manhattan, offers a solid rock foundation of the most substantial nature. Little apprehension need be felt however, for it is generally conceded by authorities on the subject that the city is not in any one of the various earthquake-belts and that this vicinity is part of an area which, considered geologically, is past the formative period by many thousands of years.

The Death of Prof. Curie.

Prof. Pierre Curie, whose researches on the radioactive elements have earned for him a worldwide reputation, was killed in Paris on April 11 last by a wagon as he crossed the Place Dauphine. His untimely death has terminated a career of unusual scientific brilliancy.

Prof. Curie was the son of a Paris physician and was born in Paris in 1859. He was educated at the Sorbonne and began scientific research on his own account while working as an assistant in the School of Chemistry of Paris. He became a professor in 1895 and at about that time he married Marie Slodowska, a Pole, one of his pupils. She had studied physics and chemistry both in Warsaw and Paris and thereafter shared with her husband the labor and honor of his most difficult experiments. It was she who discovered radium.

She and her husband spent several years in the laboratory of the School of Physics and Chemistry studying uranium and thorium and finally, in 1898, they announced to the Academy of Sciences that they had found a new and strongly radioactive substance in pitchblende. Radium was discovered in 1903. Two years before that the French Academy of Sciences had recognized the work of the Curies by awarding to Curie the La Case prize of 10,000 francs and commending his wife for her part in the discoveries. In December, 1903, the couple received the Noble prize for chemistry and a few days later they received 60,000 francs as part of the Osiris prize of France—all in recognition of their radium discoveries.

The Current Supplement.

An article on some German electrically-operated cranes, well illustrated, opens the current SUPPLEMENT, No. 1582. Mr. J. J. Carty, a telephone engineer of authority, writes on how a great telephone system is designed. The article on reservoir, fountain, and stylographic pens is continued. Mr. H. E. Field writes instructively on molding sand. The article by Mr. Alexander G. McAdie on lighting and the electricity of the air is continued. Celluloid and galalith (milk stone) are admirably discussed. Mr. William L. Price contributes a thoughtful review of the possibilities of concrete construction from the standpoint of utility and art. "Surveying on the Farm" is the subject of a well-written account by A. S. Kenyon. Perhaps the most valuable contribution which appears in the current SUPPLEMENT is that by Livingston Wright and Gordon Johnson on "How to Make a Gliding Machine." The article is so thorough and so clearly illustrated, that by following its directions an aeroplane can be easily built. A third installment of valuable alloys is published.

Automobile Notes.

The Automobile Club of America will conduct a "Two-Gallon" contest on May 5. To the weight of each car loaded 800 pounds will be added, and the product of this figure multiplied by the number of miles run will give approximately the number of pound-miles run per two gallons. The weight of double-cylinder cars will be taken as 75 per cent of their actual weight, and that of single-cylinder cars at 70 per cent. This attempt at handicapping makes it almost certain that a large 4 or 6-cylinder car will win. In fact, upon the pound-mile basis, the large car always makes the most economical showing, as the fuel consumption does not increase in direct proportion with the weight by any means. A $500 cup will be presented to the winner, which will be the car making the most pound-miles per two gallons. The entries close May 2 and a fee of $10 will be charged.

The Grand Prix international automobile race will be held in France on June 26 and 27. This race is to take the place of the Bennett Cup race, which has been held for the past six years. It will be run on two successive days, and the rules which govern it are rigorous, requiring the driver and mechanic to do all the work of changing tires and making necessary repairs. The race will be run over the Sarthe circuit, the total distance being 750 miles.

Canadian mica has been increasing steadily in value from 1895 to the present time, and that of India has been almost as steadily decreasing in value; so that, where in 1895 the imported value of Indian mica was nearly three times that of Canadian mica, in 1904 Canadian mica stood higher than Indian.

MEERSCHAUM AND ITS MANUFACTURE INTO PIPES.

Despite our familiarity with meerschaum, as used in pipes, it is safe to say that few of us have more than a vague idea of the peculiar properties of this substance, or the condition in which it occurs in nature. Nor may its chemical designation as a hydrous silicate of magnesia of the formula $Mg_2Si_2O_6+2H_2O$ prove very enlightening. The ancients believed the substance to be petrified sea-foam, hence the German name *Meerschaum*, meaning sea-foam; and a very apt name it is, for the mineral is very white and so light that it will float when dry. Pieces of meerschaum have been found floating in the Black Sea which were evidently washed out of their matrix by the waves. This may also have had its influence on the sea-foam theory of its formation.

Meerschaum is found in best quality and most abundant quantity in Asia Minor, though it also occurs in Greece, Spain, Moravia, and Morocco, and even in this country in South Carolina. The richest mines are on the plains of Eskishehr, 250 miles southeast of Constantinople. One of these mines is said to be a thousand years old, and consists of about two thousand pits within an area of six miles, all but about 150 of which have been exhausted. The mineral occurs in nodules or lumps of various and irregular sizes, buried in the alluvial deposit of the plain. Another mine comprises three thousand pits, only one hundred of which are being worked. The material is mined by the inhabitants of the surrounding villages and transported in the rough to Eskishehr. The meerschaum is soft when mined, but soon hardens when exposed to the air. For this reason the lumps are roughly scraped off at first and then laid aside to dry. When dry they are subjected to a thorough scraping and cleaning, and are finally waxed and polished. The lumps are now sorted according to size in four classes and packed in boxes labeled L., G. B., K. B., and K. P. for the German words *Lager*, *gross Baumwolle*, *klein Baumwolle*, and *Kasten polirt*, *Lager* being the largest size. In this condition the meerschaum is shipped to the pipe manufacturers.

The accompanying photographs, taken in a meerschaum pipe factory of this city, illustrate the process of forming the material into pipes. The larger pieces are cut with a band saw to a convenient size, after which the meerschaum is soaked in water until it becomes quite soft. Meerschaum when wet becomes very soapy, and will produce quite a lather if rubbed. In fact, the material serves as a very good substitute for soap, and is thus used in Morocco. Meerschaum dust makes an

Carving an Elaborate Design.

Softening and Bending the Amber Stems.

Smoothing Off the Pipes with Shave-Grass.

Waxing and Polishing the Pipes with Chalking.

Turning Up the Bowls and Stem Shanks.

Sawing Meerschaum to Pieces of Convenient Size.

MEERSCHAUM AND ITS MANUFACTURE INTO PIPES

excellent cleaning powder for removing spots from fabrics. After being thoroughly soaked, the meerschaum can be cut like cheese, and it is then roughly shaped with a knife to the form of a pipe. When dry the bowl and stem shanks are drilled, and then, if the pipe is of a plain pattern, it is turned on a lathe to the desired form. If a square-stem shank is desired, it is

Rear View of the Hair-Drying Machine.

The Electric Hair-Drying Machine.

shaped with a file. The shank is now shouldered and threaded to receive the amber stem-piece. These stems are cut from plates of solid amber, most of which is imported from Germany.

Amber occurs in many parts of Europe and America, but in largest quantity along the coast of Germany. This fossil gum is found in lumps or grains, and is melted at 550 deg. F. and refined. There are two qualities of amber, the transparent and the opaque or cloudy, the latter being much tougher and, therefore, more serviceable. The pipe stems after being tooled out are bent to the required shape. They are first immersed in oil and heated until they lose much of their brittleness. Then they are held over an alcohol flame and bent as desired. The threaded ends of the stem are protected while bending by an arbor screwed therein. The pipes are now carefully smoothed with pieces of American rush, or shave grass. The stem of the grass, owing to the natural deposit of silica, has a fine roughness which perfectly adapts it for this service. After the pipes have been properly finished with the rush, they are immersed in melted wax for a short time, depending on the density of the meerschaum, and then they are given a high polish with chalk precipitate.

Meerschaum is an excellent material for artistic carving, and some carved tobacco pipes are perfect gems of art. One of our illustrations shows a meerschaum carver working out an elaborate design. In the selection of a meerschaum pipe, one should be careful not to pick a dead white specimen. That which is of a slight creamy color will soonest take on that beautiful rich yellow-brown shade which so delights the smoker. Nor should the meerschaum be too light, as that is an indication that it is too porous to color properly, while on the other hand, a very heavy meerschaum may be almost too dense to absorb the coloring nicotine. A great many so-called meerschaum pipes are made from artificial meerschaum, a material composed of the chips and dust of meerschaum bonded with some solution and molded into blocks. The artificial product is somewhat heavier than the genuine. There are still other ways of imitating meerschaum, and a novice will find much difficulty in successfully selecting a genuine meerschaum pipe of good quality.

SOME NOVEL USES OF ELECTRICITY.

The increased use of electricity in every branch of industry is surprising even to the most ardent advocates of this mysterious form of energy. Not only has electricity invaded the territories occupied by all other forms of energy, but it has actually created new fields of its own. This is particularly marked by the present electrical invasion of our homes, where labor-saving devices were never thought of until electricity showed its wonderful adaptability to all classes of work. Electric light had scarcely ceased to be a novelty when the electric fan was introduced and then the sewing machine motor. In the past few years more attention has been paid to electric heating devices. In the nursery and sickroom electric milk warmers and devices for heating water are becoming a necessity, while the easily-regulated electric pad threatens to entirely displace the hot-water bag. Electrically-heated curling irons, electric cigar lighters, electric chafing dishes, etc., are but a few of the many electrically-heated devices now in common use. Electric flatirons are now quite extensively used in the kitchen and sewing room. Travelers find them most useful for pressing out clothing that has been mussed or creased in packing; ladies find them useful for ironing out flimsy shirtwaists and lace collars and cuffs which they would not dare intrust to the usually careless laundress. Outside of the household electric flatirons are commonly used in tailoring shops of all classes, and even architects and engineers have begun to employ them for smoothing out blue-prints and plans.

One of the latest electrical novelties is the hair-drying machine. This combines both electric heat and electric power. It consists of a casing which incloses coils of resistance wire and an electric fan. The fan sucks air into the casing over the resistance wires and the latter heat the air to any desired temperature under control of the operator. A flexible tube communicates with this casing and receives the current of heated air, permitting the operator to direct the current where desired. When properly handled twelve persons can be treated in one hour at a cost of but a fraction more than one cent each. The kitchen offers an excellent field for electrical apparatus. Already many electrical cooking outfits have been invented. The electric range is a convenient little piece of kitchen furniture whose chief charm lies in the fact that it is ready for instant use at the touch of the switch, and immediately after the cooking is done, the power can be cut off. This results in a great saving of expense, doing away entirely with that wasteful consumption of energy which is necessary in coal ranges in keeping the fire going so that the range will be ready for use. The electric range also possesses an advantage over the gas stove, its closest competitor, in that no match is required to light it, and it is entirely free from odors. One of our illustrations shows a small electric broiler which will cook a medium-sized steak at a cost of but two cents.

Washing Dishes in an Electrically-Operated Machine.

The electrical restaurant, shown in another of our illustrations, serves to exemplify the convenience and adaptability of electricity to kitchen work. It will be seen that the cooking apparatus is placed in the center of the restaurant with no attempt to screen it off from the rest of the room. Here the manager, in a business suit, does the cooking while chatting with his patrons with no fear whatever of smoke, soot, or ashes spreading out into the room, while the cooking smells are drawn up through a ventilator just above the range. A whole chicken can be roasted in a quarter of an hour and lamb chops can be broiled in three minutes. This rapid cooking results in retaining the juices of the meat.

The advantages offered by the kitchen for the development of electric power devices have not as yet been fully realized. The kitchen is the workshop of the house, and affords a splendid opportunity for labor-saving apparatus. A well-ordered kitchen should have its electric fan set in the wall to draw off the heated air and odor of cooking from the building. Small electric refrigerating plants are provided to do away with the inconvenience of hauling ice into the house. As yet electric labor saving apparatus has not been introduced to any large extent in private houses, but some of the accompanying illustrations, which show its uses in hotels, will be suggestive of its possibilities in the home. Here may be seen the electric dishwasher, the dishes being piled into an open wire basket and dipped into boiling water which is whirled rapidly against them by an electric motor. The same operation repeated in

An Electric Broiler. Electric Flatiron.

The Knife-Polishing Machine.

A Restaurant Equipped With an Electrical Kitchen.

SOME NOVEL USES OF ELECTRICITY.

three different vessels will thoroughly clean the plates, after which an electric fan is used for drying them. The entire operation requires but a few minutes. The knives can be scoured and polished by passing them between a pair of rapidly-rotating buff-wheels, and an emery wheel is provided for sharpening the steel blades. But the use of the electric motor in the kitchen is not confined to cleaning apparatus. A number of electrically-driven machines have been devised for preparing food. Two of these are shown herewith. One of them consists of a cabbage-chopping machine, and the other is a potato-paring machine. The latter discharges potatoes fully pared except for the eyes, which can readily be cut out by one of the attendants. It will be evident that these are but a few of the different uses to which electric power can be applied, and it is expected that the next few years will add wonderfully to the present variety of electric labor-saving devices for kitchen use.

We are indebted to the *Bulletin* of the New York Edison Company and to the Siemens-Schuckert Works of Berlin for the photographs used in illustration of this article.

New Departure in Animal Study.

BY P. MARDE SMITH.

With practically nothing known of the diseases of wild animals, the establishing of the Infirmary and Laboratory of Pathology for the inmates of the Zoological Garden of Philadelphia is an interesting departure. The office of the Zoological Society is in the quaint little old mansion, called "Solitude," which was built by John Penn, the nephew of the founder of Pennsylvania. Standing rather near the main entrance, this plain and dignified one-story building consists of a central hall, running through it, and four large light rooms. To the right of the entrance is the laboratory. Immediately back of it is the *post-mortem* room. To the left is the infirmary, and in the rear of it is the quarantine room. New arrivals for the collection go at once into the quarantine room, provided they are of moderate size, that they may be examined and watched for a certain period. Smaller animals on the sick list are placed in the infirmary, and, truth to tell, our friends (or relatives), the simia, are in the majority. As a rule, from one to half a dozen may be found in this pleasant room.

In the *post-mortem* room there is a refrigerating plant, a dissecting table, barrels of formaldehyde (one a 10 per cent, the other a 40 per cent solution) and Muller's solution, and a barrel of "remains." It is indeed uncanny to see a section of what is mortal of an animal friend, which one has admired and taken sugar to for years, but the spirit of which has passed on—one hopes to eternal sweets, or fruit, or tenderloin steaks, or whatever it best likes.

Long tables are built into three sides of the laboratory, while at the table in the center there is always some work being carried on. Upon it is placed the microtome, which is an interesting instrument for cutting tissues into sections of tissue-paper-like thinness. Though these sections are usually cut from 1/250 to 1/500 of an inch in thickness, or rather thinness, the microtome has a capacity of 1/2,500 of an inch. This thinness is necessary, that the specimen, which by this time is mounted on a glass slide for use under the microscope, may be seen through.

The specimens as they come from the autopsy are placed in fixing solutions, and then in alcohols. Lastly they go into paraffine, liquid or solid, and after four to eight hours in the incubator, at 52 deg. Cent., or 122 deg. Fahr., they come out imbedded in this remarkable substance, and ready for cutting in the microtome. One or two specimens are taken of each organ, averaging about 14 to an animal. In the *post-mortem* room Dr. Courtland V. White, who heads the staff of this new infirmary and laboratory, dictates changes, and anything abnormal is made a note of. The final touch to the specimens is to mount them on glass, and color them with haematoxyton.

One incubator is full of culture media, and in these cultures many sorts of bacteria are being grown in anything from milk to Japanese moss (agar). One culture is alive with typhoid, another with tuberculosis. There are many of these cultures, and despite their smallness they hold enough deadly bacteria to kill a million people.

It is hoped and predicted that improved hygienic methods will be discovered, and new serums against dread disease for the benefit of mankind, as well as the lower animals. This new departure has cost $9,000 for the building and $2,000 for the apparatus.

A Substitute for Sponges.

In Algeria, the cultivation of "vegetable sponges" is now making progress. The cultivation of this plant (of which about ten species are known, and cultivated, in the warm regions of Asia and Africa) is fairly extensive in the environs of Algiers and Oran. Prior to maturity the fruit is edible; when the stage of ripeness has been passed, however, the pulp becomes separated from the fibrous matter which then forms the spongy mass termed the "vegetable sponge." Fine specimens, when carefully bleached in a weak lime bath, are sold at from 3½ to 4½ pence apiece. Paris is at present the chief market for most of the vegetable sponges grown in Algeria. They are highly suitable not only for toilet and bathroom, but also for domestic purposes.

Work Standing and Seated.

Is manual labor better done standing, or in the sitting posture? A question as interesting from the individual as from the social point of view. We know that those who practise the trades and the most deli-

Electric Potato-Paring Machine.

cate arts seated often rise to consider their work with more precision, or to perfect its details. And the physiologists admit, on the other hand, that the standing position is the attitude that best assures stability against exterior forces, and so obtains the best fulcrum in the various activities.

Nevertheless, it was not futile to confirm these somewhat theoretical considerations by experiment. That is what M. Charles Ferré has done by means of the ergograph, an instrument that allows registering the number of liftings of a given weight by the middle finger, and the extent of each movement of this finger. Now, the result of these experiments is to show that work standing is about one-tenth superior to work seated. But, if we compare these works at their beginning and at their end, we notice that work seated is less considerable at the beginning and gradually subsides, while remaining pretty intense at the end; whereas work in the standing position is more intense at the beginning, persists for a long time very high, then rapidly falls.

The standing position, then, favors work and appli-

Electric Machine for Chopping Cabbage

SOME NOVEL USES OF ELECTRICITY.

cation during a long period; but it is certain that this exaltation is followed by a more rapid fatigue. By experiments of the same sort M. Ferré has ascertained, moreover, that a long period of inactivity preceding work diminishes the value of the latter, whereas a short period of inactivity of five or ten minutes is followed by an improvement in the work. After an hour of inactivity work is reduced to its minimum. It seems that the subject is torpid or asleep. Practical deduction: the pauses from work, as between two classes, should never exceed fifteen minutes.—From Illustration (Paris).

FRANKLIN'S SCIENTIFIC WORK.

Rather late in his very active life the tenth of Josiah Franklin's sons had occasion to set down the impressions of his remarkably varied and successful career and to reflect, in a graceful yet simply-worded autobiography, on the meager advantages that he had inherited from his father. Two of Josiah Franklin's attributes were singled out by his youngest son as the most noteworthy in his heritage. "A sound understanding and solid judgment in prudential matters, both in private and publick affairs," was the first; the second was "a mechanic genius" in being "very handy in the use of other tradesmen's tools."

Of Franklin's "sound understanding and solid judgment" historians have written at length; of his "mechanic genius" little is popularly known beyond the picturesque facts of his early days spent in candle-making shops and in printing offices.

Franklin's interest in electricity, the field in which his mechanic genius expressed itself most originally, began in his fortieth year. A Dr. Spence appeared in Boston in 1746 and exhibited some crude electrical apparatus on the mysterious working of which he dilated in popular lectures. Franklin heard him and was interested, despite the fact that Spence was not over-skilful in manipulating his apparatus nor over-illuminating in his explanations. When Franklin returned to Philadelphia he repeated some of Spence's experiments with a glass tube that had been sent over by Peter Collinson, a merchant who had an extensive trade with the colonies and who took a lively interest in the Library Company with which Franklin was actively connected. After a year's experimenting Franklin was convinced that he had made advances of real import and sent to Collinson an account of the first electrical discoveries made in America. Early in that famous scientific correspondence he referred to the "wonderful effect of pointed bodies both in drawing off and throwing off the electrical fire" and told Collinson how a cork suspended by a silk string was repelled after contact with an electrified cannon ball, and how a steel bodkin held near the ball conducted the electricity away from the iron so that the cork fell back and was no longer repelled by it.

The rubbing of a long tube with buckskin proved too tedious in the end, and so Philip Sing, one of Franklin's associates, transformed the tube into a ball, provided it with an axle and a driving wheel after the manner of a grindstone, and thus reinvented the electrical machine.

All this was done by a man naturally apt in the handling of instruments, guided only by the books which Collinson had supplied, by Collinson's brief letters, and by Spence's awkward demonstration. Of contemporaneous European work nothing was known. In a way it was fortunate that Franklin knew nothing of the electrical investigations which were then conducted in Europe, for he was thus led to explain in his own way the cause of the "drawing off" action of pointed rods. He proposed a theory that accounted for the observed facts with singular simplicity. The phenomena observed could be explained, he argued, by assuming that there is a certain quantity of electricity naturally belonging to every substance in its unexcited state. If by suitable means that quantity be increased, the substance may be said to be plus or positively electrified; if diminished, minus, or negatively electrified. Adding to this hypothesis the view that electricity is self-repellent and attractive of matter generally, he was able to construct satisfactorily what has since been called the one-fluid theory of electricity in contradistinction to the two-fluid theory of his European predecessors and contemporaries.

Curiously enough modern physicists are reverting to Franklin in their negative-corpuscle theory. The idealistic school of English scientists, headed by Thomson, Lodge, and Crookes, account for negative electricity by the discharge of a negative corpuscle from a positively-charged body. Just why this action should take place we are no better informed than was Franklin. In two hundred years we have advanced not very much beyond him, so far as the philosophy of static electricity is concerned. Of the electric spark and of lightning we know but little more than he did.

We need not here repeat the story how several persons before Franklin's day had detected the resemblance between lightning and electricity, but that no one had yet entertained the magnificent idea of examining the suggestion experimentally; how Franklin proposed to present a long, pointed conductor to a thunder cloud in order to withdraw the electricity from it, if any it had; how in France instruments constructed in accordance with his principle proved the expected identity; how almost simultaneously he himself in Philadelphia succeeded by means of a kite; and how he applied his discovery in the lightning rod. We may be permitted to observe, however, that his kite experiment is one of the most brilliant examples of luck yet recorded. To attempt the extraction of lightning flashes from a lowering sky was almost suicidal. Even at this late day timid persons occasionally fly to feather beds, sit on glass-legged chairs, or find refuge

in rubber boots, during thunder storms. A repetition of Franklin's experiment cost his immediate imitator his life.

The correspondence in which Franklin outlined the experiments which were subsequently crowned with such conspicuous success was offered by Collinson to the Royal Society for publication and almost derisively rejected by that body. Later the letters were published by Dr. Fothergill, widely circulated and translated. To the credit of the Royal Society be it said that, some years afterward, it elected Benjamin Franklin an honorary member and bestowed on him its highest honor — the Copley medal.

Franklin's Electrical Machine.

Franklin's scheme of erecting lightning rods to conduct atmospheric electricity to the ground and thereby protect buildings was at first hotly opposed. After the utility of the lightning rod was established by abundant proof, another wordy war was waged as to the advisability of employing pointed or blunt conductors. Franklin advocated the pointed rod; against him was arrayed a regiment of English electricians. Because the controversy affected his own royal abode, Buckingham Palace, a wise monarch whose philosophic intellect had once marveled at the culinary feat of introducing apples into dumplings, graciously considered the matter, decided that pointed conductors "were a republican device calculated to injure his Majesty," and ordered the substitution of ball rods for the revolutionary but more practical pointed conductors. "The king's changing his pointed conductors for blunt ones," said Franklin, "is a small matter to me. If I had a wish about them it would be that he would reject them altogether as ineffectual."

Franklin's dramatic kite exploit added a new interest to the Leyden jar. Ladies and gentlemen of fashion at the courts of England and France, instead of whiling away their evenings at piquet and bezique, rubbed glass tubes, stood on insulated stools and extracted sparks from one another. Franklin became so identified as the conqueror of the lightning that artists produced engravings of him in which he is pictured as the center of Louis the Sixteenth's admiring court, crowned by noble ladies; or in which he is represented imperturbably seated near an open window with forked flashes darting across an ominous sky.

Franklin's own work with the Leyden jar led him to adopt the correct view that the connected coatings "served only like the armature of the lodestone to unite the force of the several parts and bring them at once to any point desired," and that the electricity existed only on the glass.

Franklin's contributions to science are not limited to his electrical discoveries and inventions. Out of many such two deserve special mention. They are the course of the North American storms and the effects of the Gulf Stream.

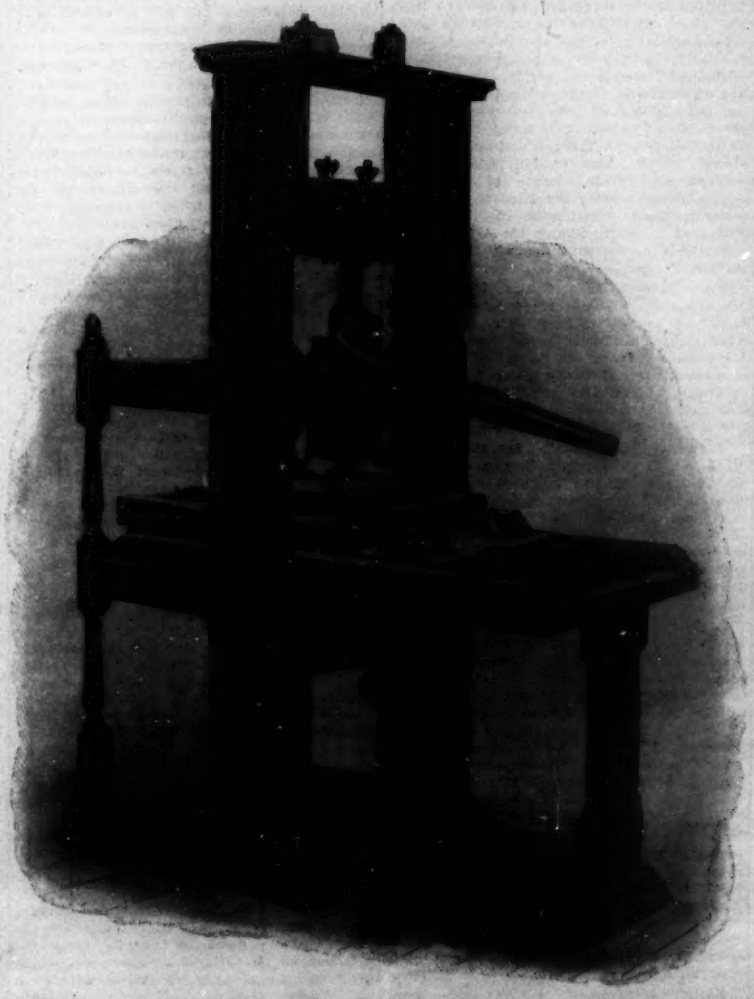
He relates the circumstance of his meteorological discovery in a letter dated February, 1749:

"You desire to know my thoughts about the northeast storms beginning to leeward. Some years ago there was an eclipse of the moon at nine o'clock in the evening, which I intended to observe, but before night a storm blew up at the northeast and continued violent all night, and all the next day, the sky thick-clouded, dark and rainy, so that neither moon nor stars could be seen. The storm did a great deal of damage along the coast, for we had accounts of it in the newspapers from Boston, Newport, New York, Maryland, and Virginia; but what surprised me was to find in the Boston papers an account of an observation of that eclipse made there, for I thought as the storm came from the northeast it must have begun sooner in Boston than with us, and consequently prevented such an observation. I wrote to my brother about it, and he informed me that the eclipse was over there an hour before the storm began. Since which I have made inquiries from time to time of travelers and of my correspondents northeastward and southwestward, and observed the accounts in the newspapers from New England, New York, Maryland, Virginia, and South Carolina, and I find it to be a constant fact that northeast storms begin to leeward and are often more violent there than to windward. Thus the last October storm, which was with you on the eighth, began on the seventh in Virginia and North Carolina, and was most violent there."

Now we know that almost all the chief atmospheric disturbances of this continent pass in an easterly or northeasterly direction toward the Atlantic Ocean. It follows, then, that the approach of these storms can be foretold by telegraph, and so with minor disturbances at variations in atmospheric pressure.

The Gulf Stream was, of course, known long before Franklin's day; but he it was who caused the first chart of it to be made; the first who showed its splendid proportions and its geographical and climatological importance; the first to detect its most salient characteristic (its high temperature), and the first to introduce the thermometer as a means of fixing its location.

It is not amiss to regard Franklin as the first American heating and ventilating engineer; for between the years 1740 and 1745, his scientific investigations had for their purpose the prevention of the wasteful use of fuel. His researches caused him to make a careful study of all the different methods of house heating, with the result that he invented the Pennsylvanian fireplace, which brought about a great economy of fuel and a properly heated room. The real Franklin stove is not the contrivance which has masqueraded under that name; it was an apparatus which took cold fresh air outside of the house, and after warming it in passages kept hot by the escaping gases of the fire, finally discharged into the room. Had this old Franklin fireplace been enlarged and slightly altered and placed in the cellars of our houses, it certainly would have become the prototype of all our hot-air furnaces. During the eighty-four years of Franklin's busy life he devoted at the most only seven or eight to scientific study. Unprovided with measuring apparatus, he must be regarded as an experimental philosopher rather than as a scientist in our acceptance of the word. He could only guess shrewdly at the probable causes of the effects that he observed because he had no instruments of precision at his disposal. It remained for Galvani and Volta to provide a more promising means of studying the phenomena of electricity with the exactitude demanded of science.



Benjamin Franklin's Printing Press.

FRANKLIN'S SCIENTIFIC WORK.

Houdin's Bust of Franklin.

New Method of Preserving Fruits.

L'Illustration has the following:

"We know that the difficulty of preserving fruit lies in the rapidity with which pulpy fruits are impaired under the action of the organisms, fungi, and bacteria living upon their surface. Starting from this point of view, some English scientific men deduced from it that if these micro-organisms could be destroyed the period during which the fruit could be maintained in excellent condition would be considerably prolonged.

"The method which has furnished the best results to these inventors rests upon the immersion of the fruit in cold water containing three per cent of the commercial solution of formol. If fruits with soft pulp (like cherries, strawberries, and grapes) be in question, they dip them for ten minutes merely in said solution; then they steep them for five minutes more in cold water; and, finally, they spread them out upon a wire gauze or any other convenient arrangement, there to drain and dry. But when the fruit has a peeling or skin that we do not eat, there is every advantage in submitting it merely to the formol solution.

"Experience has shown that fruit having undergone this treatment has remained absolutely sound, when a like quantity of fruit of each kind (taken for proof) had become moldy and decomposed in a space of seven days for the cherries, four days for the strawberries and grapes, and ten days for the pears.

"M. Truelle, in making known these facts to the Society of Agriculture, remarked that this treatment could be applied to wine-press fruits, whose greatest enemy is decay."

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC PROGRAM-CLOCK. — A. L. RONELL, Forest City, Iowa. Among quite a number of separate objects in the present invention, are the following: to economize battery power; to provide a system in which any desired timing-clock may be employed by making in it comparatively trivial changes; to readily prevent certain alarms from being actuated temporarily without interfering with other alarms, and to provide certain constructional details tending to promote efficiency, simplicity, and reliability in the action of the alarm. This invention constitutes an addition to another described in Mr. Ronell's former Letters Patent for a time-controlled electric alarm.

ART OF SUSPENDING AERIAL CABLES.—L. A. MCNEIL, Maywood, Ill. The principal objects of the invention are to facilitate the erection of electric and like aerial cables. Erecting a cable upon a suspension-wire in which this latter is fixed in supports upon all the poles and in which open hooks are drawn over such wire by action of the capstan is objectionable. This invention obviates this difficulty, there being but one person required to manipulate hangers and close hooked loops, the process of these by the supports being automatically effected. This is done without diminishing security of the supports, the suspension-wire being so held that no amount of vibration can displace it.

ADJUSTER FOR ELECTRIC-LIGHT CORDS.—J. T. HATHERLY and T. H. HATHERLY, New Westminster, Canada. This invention relates to adjusters for electric-light cords, the purpose being to produce a device very simple of construction and which may be readily manipulated in order to dispose of any quantity of slack in the cord resulting from the particular position or height desired for the light carried by the cord. They are made of paper, rubber, glass and light metals.

TELEPHONE-RECEIVER SUPPORT.—F. F. HOWS, Marietta, Ohio. The improvement is in telephone-receiver supports, and in its employment a lower arm and its offset extension are adapted to underlie a wall-board and two clamps faced with felt or other suitable material are adapted to engage the face near one edge and the opposite edge, respectively, thus obviating the necessity of marring the wall-board by screw-holes.

Of Interest to Farmers.

HORSE-HOE.—F. W. ANDERSON, Westfield, N. Y. This disk horse-hoe is for use in cultivating grape-vines, raspberries, shrubbery, and plants of various kinds. The main feature of the novelty is the construction and combination of parts whereby a hoe or cultivating-blade may be adjusted to and held at different vertical and horizontal angles.

HAY RAKE AND STACKER.—O. B. MANN, Meeteetse, Wyo. The purpose in this case is to provide a rake or stacker which will gather up hay as the machine advances and when a load is obtained whereby the rake may be raised so that its load may not trail upon the ground while the machine is being drawn to the stack, and, further, when the stack is reached whereby the rake can be elevated as desired, held elevated, and the load discharged, and, furthermore, wherein the rake-teeth may be given any inclination upward or downward, all under control of the driver seated at the back of the machine.

PLOW.—R. NELSON, San Martin, Cal. This invention relates to plows and especially to the type known as "sulky-plows," the frames of which are mounted upon wheels. The object is to provide improved means for attaching the wheels to the frame to the end that the height of the frame carrying the plowshares may be readily readjusted. An improved arrangement is provided for attaching the tongue or pole of the plow to the frame.

RIDING-HARROW.—P. FLEMING, Burton View, Ill. In the operation of this improvement the central and side harrows would be lowered into contact with the ground and the teeth adjusted at a suitable inclination with respect to the harrows. In moving the machine from place to place the outer end of the side harrows would be elevated and engaged with the hooks on the frame and the central harrow could be elevated out of contact with the ground, thus leaving all parts free from the ground except the wheels. If desired, a tongue may be secured directly to the frame.

MILK-PAIL.—J. LOWE, Hutchinson, Kan. This invention constitutes an improvement on the device formerly patented by Mr. Lowe. It related to an attachment for milk-pails which enabled the pail to present supports on opposite sides of the body of the pail, and adapted to support the pail from the knees. The object of the present improvement is to provide means for attaching the supports to the end that they may be normally held out of the way and against the side of the pail, but enabling them to be readily thrown into the projecting position adapting them for use.

MEDICATED NEST-EGG.—G. H. JONES, Los Angeles, Cal. It is desirable that the eggs used for the purpose of destroying or driving away vermin should not give off fumes too rapidly, which would endanger the lives of the embryo chicks. The inventor's purpose is to produce an egg in which the medicated compound may be placed with facility, and, further, to provide means whereby the exudation from the egg will take place slowly and substantially uniformly.

HOG-TROUGH. — J. CROSSIN, Ava, Ill. Economizing time and labor in feeding hogs and also preventing the animals from getting their feet into the trough while the feeder is feeding, also to arrange it so that each one gets its share of feed by preventing them from fighting each other away is the principal object of the inventor. The trough is formed with separate feeding compartments.

AGRICULTURAL IMPLEMENT. — C. D. ADAMS, Sylvania, Ga. The principal objects in this case are to provide a machine with a motor to be driven by electricity, gas, gasolene, or the like, to connect the motor with traction-wheels so as to propel the machine, and to attach various kinds of implements to it in such a manner that they can be readily operated either by the motor or by forward motion of machine, at same time keeping the dimensions of machine within narrow limits, so that it will be suitable for general use and not require an extraordinarily large expenditure of power in operation.

POTATO DROPPER AND PLANTER.—F. R. ALBRIGHT and J. S. JOSEPH, Norristown, Pa. In operation, the hopper being filled with potatoes, the planter is drawn along with the leg following the furrow. Picker-arms are rotated in reverse direction to the motion of the planter, and the arms pass upwardly through the hopper, the needles transfixing and carrying upward a potato during their passage. Pairs of arms upon a shaft engage the picker-arms and knock the potato therefrom, which drops into the flaring mouth of the leg and passes down into the furrow. The concaved wheel both steadies the potatoes in their place and aids in covering them with dirt.

Of General Interest.

HOLDER FOR STAPLES, ETC.—J. A. BLAKE, Lafayette, Ind. Mr. Blake's invention is an improvement in devices for use in the manufacture of concrete fence-posts, and it is in the nature of a holder of staples and for reinforcing spacers in applying said staples and spacers to the soft concrete in a mold.

PLUMB, LEVEL AND INCLINOMETER.—W. A. DIMICK, Vancouver, Wash. This instrument is adapted for use in construction of roadways and sidewalks or erection of buildings, so as to quickly and accurately determine if structures or parts thereof are level or properly inclined or vertically positioned, as the character of work may require. The object is to provide features of construction which afford a combined "plumb," "level," and "inclinometer" in one small instrument, which may be readily secured upon a straight-edge of suitable length.

BRIDLE.—C. HAY-HAY, Red Lodge, Mont. The object here is to provide details for a driving-bridle to be used for double or single harness which permits an accurate, quick, and convenient adjustment of the crown-straps and check-straps of the bridle, so as to give the latter proper length for connection with the bridle-bit without changing the position of the blinders on the crown-strap, if this is correct, or to raise or lower the blinders without altering the length of the check-straps, so as to give the blinders the proper position, these adjustments enabling speedy fitting of a bridle having the improvements upon heads of different animals that may vary in sizes.

FENCE-POST.—J. A. BLAKE, Wolcott, Ind. Mr. Blake provides a concrete post reinforced from end to end by longitudinal reinforcing-wires, stayed at intervals by brackets, which also operate to support the wires within the mold in the operation of molding the post, the said posts being also provided with simple and effective means for securing the fence-wires in the use of the post in fencing.

SUPPORTER. — SARAH LIPKOWITS, New York, N. Y. The object in this instance is to provide a new and improved supporter for use on children's garments, corsets, suspenders, and the like, and arranged to form a proper support for bands, trousers, hose, and the like garments, and to allow convenient connection or disconnection of the parts, and to prevent the garment parts from becoming entangled and injured in the supporter.

ADJUSTABLE SEAT AND DESK.—J. T. BRENT, Second, Cold Spring, N. Y. This invention relates to a desk and seat for use in schools and similar places. The principal objects of the inventor are to simplify articles of this character by forming the main parts of metal and to so put together the several pieces of metal constituting the article as to afford simplicity of construction and strength, together with lightness, in the finished article.

GRAPHITE-SEPARATOR. — J. H. DAVIS, Glens Falls, N. Y. The principal objects of the invention are to provide means for effectively separating both fine and coarse graphite and retaining practically all of that material which may be in the ore, for collecting sand and other materials which may be included with the graphite in the ore, to produce graphite in the pure marketable form, and to wash it clean from all foreign matters.

SAFETY-RAZOR.—F. A. CLAUBERG, Weehawken Heights, N. J. This type of safety-razor is so constructed that two removable and interchangeable blades are employed which when placed in a body-frame back to back present two opposing cutting edges, the blades being primarily shaped for the purpose intended and made of sufficient thickness to admit of beveling their cutting edges, which bevel is so deep that the blades can be repeatedly honed, ground, and stropped with the best results.

GUN-STOCK.—W. F. COLE, Waco, Texas. In constructing the ordinary gun-stock the wood composing it is cut across the grain at the grip or narrowest portion adjacent to the breech, where it is consequently vitally weak, whereas in the present improvement the stock grain is preferably continuous or uncut, and the stock therefore possesses as great strength at one point as another, besides being lighter than the old form and adapted for advantageous use in handling the gun.

SWEAT-BAND.—R. H. CURTIS, Long Branch, and H. D. CURTIS, Red Bank, N. J. One purpose of this invention is to provide a band having folding flexible members or leaves upon its inner face so arranged that when folded up in direction of the free edge of the band in a hat the band will represent a given normal size, and wherein when the said members are folded in direction of the edge of the band which is attached to the hat the interior measure of the sweat-band will be reduced about a half-size.

REVOLVING DRUM-SCREEN.—J. P. BREW and E. P. SUITER, Basin, Mont. This invention is in the nature of a screen designed to be used for the purpose of screening the slime-water of the concentrator either before or after it is worked on the concentrator-jigs, the slime-water being worked over for whatever value it may still contain. The drum's periphery is formed of screening-wire in which the materials to be screened are applied to the outer surface of the drum and pass through the wire to troughs inside the drum and in which refuse matter clinging to the wire mesh is constantly removed and the screen kept in clean, effective condition.

SHADE.—L. W. HAIGHT, White Plains, and W. E. CHAPMAN, New York, N. Y. The invention refers to a shade intended particularly for electric lights, but useful in connection with other lights. The object is to produce a means by which the light may be subdued and reflected in various colors and figures. Also to produce a shade and reflector which will enable the lights, particularly electric lights, to be hung in fanciful groups, taking the place of the usual chandelier.

STAND FOR LIQUID-CONTAINING VESSELS.—O. HAMMARLUND, New York, N. Y. This improvement has reference more especially to stands or holders for bottles, decanters, and the like of the type comprising glass or other solid stoppers; and one of the principal objects is to provide a structure in which one or more bottles, etc., may be placed so that the removal can only be effected in a certain way or by employment of special means, thereby preventing unauthorized or surreptitious abstraction of any of the liquid contents thereof.

LOG-CHOCK.—J. E. KNIGHT, Blue Canyon, Wash. An object of this invention is to provide a chock for holding logs on cars, trucks, and other means of transportation, which chock may be readily released to enable the logs to be rolled from the car without the necessity of a person going to the side of the car from which the logs are to be rolled.

COMBINED MINNOW BUCKET AND TRAP.—F. PETMECKY, Austin, Texas. An outer bucket of ordinary form is employed, together with an inner one having specially-constructed heads applied to the ends thereof, making of this bucket a trap. Said inner trap-bucket is also of special construction, by which the working capacity thereof may be varied in use.

FLUSH-VALVE.—E. D. BARRETT, Plainfield, N. J. The principal object of the inventor is to provide means for permitting a sudden rush of water through the valve when opened, whether the admission-pipe is the same size as the outlet-pipe or smaller, and to provide for the gradual closing of the valve, so that a constant stream will pass through for some time without the necessity of holding the valve open.

LEDGER.—W. WYLIE, Los Angeles, Cal. The ledger comprises a plurality of sheets transversely perforated, dividing each into a short upper and a long lower portion, and ruled vertically upon each side to divide the sheet into vertical halves, the upper portion ruled upon each side transversely into a series of lines, and each half ruled vertically to form a column headed "meter number," and columns for names and street-number, one-half of lower portion ruled to form column for dates, and columns headed "Statements," etc., the other into columns headed "Statements," "Total," etc., and entire lower portion ruled transversely into spaces for one month's business, said spaces bearing, in date's column, names of the twelve months, respectively.

FIREPROOF FIXTURE. — E. F. FITZPATRICK, New York, N. Y. This patentee's invention has reference to fireproof fixtures—such as partitions, blinds, doors, walls, and the like—his more particular purpose being the provision of an inclosed air-space, sometimes designated as a "vacuum," which acts as a non-conductor of heat.

CONTAINER FOR CIGARS.—S. C. MABUM, New York, N. Y. This container comprises rear and side walls between which the cigars may extend, and separated front bars connecting the side walls and serving to retain the cigars in place, while permitting them to be seen in display. One of said bars has an extension, furnishing a closure with which the inner ends and adjacent sides of the cigars may contact, the side and rear walls being extended at the opposite end to form a closure for the container.

DRAFT ATTACHMENT FOR HAMES.—F. J. MARTIN, Putney, Vt. In animal-harness the point of draft strain should be at a proper distance above the strap connection between the lower ends of the harness, so that such strain is imposed upon the padding of the collar at a point that insures a proper pressure upon the shoulders, and this point for imposing pressure varies in different animals. To enable making a convenient change and adapting the harness for comfortable service, Mr. Martin has devised the attachment for connecting the front ends of tug-straps with the harness.

ROOFING.—H. M. JACKSON, Lancaster, Ohio. This inventor improves means for securing slates on roofs and protecting the edges of the courses laid thereon. In laying slate in single lap in the usual way the first and last rows of nails are exposed and small spaces between the slats and roof are left open along the side edges of the roof. He provides a securing and protecting device which not only adds to the security and efficiency of the roof-covering, but also to its ornamental appearance.

STERILIZING AND ANTISEPTIC CASE WITH STAND FOR SURGICAL INSTRUMENTS.—P. BRIGANTI, New York, N. Y. This invention refers to a case and stand for surgical and dental instruments, the principal objects thereof being to provide means whereby the instruments can be effectively treated by an antiseptic solution and then transported to any place where it may be necessary to use them in an operation without contaminating them in any way; also to provide means for holding the instruments and to provide for introducing and discharging the solution.

MARINE LOCK.—J. DIAMANT, New York, N. Y. In this case the invention refers to hydraulic engineering; and its object is to provide a new and improved lock for canals and other waterways and arranged to permit of raising or lowering marine vessels from one water-level to another without the loss of water and with the expenditure of comparatively little power.

LETTER-CARRIER'S MAIL-DEPOSIT BOX.—T. VAN M. DAVIS, Portland, Ore. In the form of the improvements made by Mr. Davis, he employs a mail-deposit box of special construction having special means for fastening the same to a suitable support therefor, and provided with a door or closure which may be fastened or secured in place by a suitable lock that is to be opened only by the letter-carrier or other person in authority.

ACCOUNT-FILE.—J. O. WILHELM, Limaville, Ohio. A purpose of the invention is to provide a file which will also serve as a registry of the accounts filed therein and to so construct the file that the captions of all of the outermost bills contained in the file and accumulated in one or more days or in a given period of time will be visible at a glance and the underlying bills will be equally visible as the outermost ones are removed.

GARMENT-FORM.—E. T. PALMENBERG, New York, N. Y. In the present patent the invention has reference to apparel apparatus, and its object is the provision of a new and improved garment form arranged to allow convenient and quick interchange of different arms, heads, and shoulders, according to the style of dress to be displayed.

PROPELLER-WHEEL.—A. H. LITTLE, New York, N. Y. The principal object of the inventor is to provide means on the blades of a screw or similar propeller for acting upon the water after the main part of the blade has passed through it, so as to recover some of the power that is lost by the speedy rotation of the blades and cause the boat to attain greater speed and in general give more satisfactory results.

RIBBON-HOLDER.—R. A. GLADNEY, Marion, Ark. The object in this instance is to provide a ribbon-holder for use in retail dry-goods stores, fancy-goods stores, and like places and arranged to permit mounting a coil of ribbon for convenient display and unwinding lengths as desired by purchasers without danger of the roll of ribbon being soiled by unduly handling the same or dropping it to the counter or floor.

LUBRICATOR.—G. SLOAN, North Yakima, Wash. The invention relates to lubricators in which a spring-pressed plunger forces a turgid lubricant or grease to the part to be lubricated. The object is to provide a lubricator arranged to insure a constant feed of the grease to the part to be lubricated and without danger of leakage of the grease past the spring-actuated plunger.

RAZOR-BLADE HOLDER.—J. H. HUNT, Massillon, Ohio. The purpose here is to provide a device for holding razors or like blades during stropping or honing, being particularly adapted for use in connection with the blades of safety-razors, and to so construct the device that it can be conveniently opened and closed and otherwise operated by one hand. The aim

also is to simplify and render more effective construction set forth in Mr. Hunt's improvements formerly allowed.

ADJUSTABLE HORSESHOE-CALK.—T. W. J. McGANN, Washington, D. C. Mr. McGann has made two inventions in the nature of an adjustable horseshoe-calk for rendering the horse rough-shod without removing the shoe. The first relates to that form of adjustable calk in which a plate applied externally to the toe part of the shoe is formed with two hook-shaped claws which hook around the front edge of the shoe and penetrate a short distance between the shoe and hoof and by means of which plate a movable calk-section is secured. He provides a detachable calk easily applied and removed and yet so strongly connected that its parts do not become loosened by hammering action of hoof on the road-bed. In the second he provides a detached calk which shall be easily applied and removed and yet so strongly connected that its parts do not become loosened by hammering action of the hoof on the road-bed. In calks of this character the trouble has been to maintain a rigid connection of the calk to the shoe under the severe strains to which it is subjected.

DETACHABLE HEEL-CALK FOR COMPOSITE RUBBER-PAD HORSESHOES.—T. W. J. McGANN, Washington, D. C. The design in this invention is to provide a detachable heel-calk applicable to that class of composite horseshoes which are known as "three-quarter shoes," which are provided at the heel with a rubber pad. This shoe is rendered rough-shod for slippery roads without having to take off the shoes or send the horse to the blacksmith.

DETACHABLE CALK FOR RUBBER-PAD HORSESHOES.—T. W. J. McGANN, Washington, D. C. A detachable calk is provided for the toe and heel of that form of composite shoe which is made of a skeleton frame of metal having its recesses filled with rubber which forms a full tread-surface of an elastic quality. This form of shoe is well known and while cushioning the blow of the hoof on the road-bed has but little durability and is not effective in preventing slipping when sleet or ice is on the roadway. The invention is especially adapted to this form, but applicable in some features to the metal shoe.

DETACHABLE HEEL-CALK FOR HORSESHOES.—T. W. J. McGANN, Washington, D. C. The invention relates to heel-calks for rough-shod horseshoes; and it is designed to supply a detachable calk which may be easily and quickly applied to or removed from the shoe while on the hoof without any drilling or machine work and without requiring the animal to be sent to the shop. Mr. McGann has invented another detachable heel-calk for horseshoes which relates to detachable heel-calks for the ordinary flat or plain horseshoe; and it is designed to supply a detachable calk which may be easily and quickly applied to or removed from the shoe while on the horse's hoof, so as to give a plain shoe the quality of a rough-shod shoe. The same inventor has made another detachable heel-calk for horseshoes, an invention which relates to that form of detachable heel-calks which is made in the form of a bridge-piece that extends across the rear ends of the shoe from heel to heel. The difficulty has been with this form to insure its firm adherence to the shoe against getting loose and coming off. He provides means for accomplishing this and supplies an efficient heel-calk that can be applied by any one without sending the horse to the blacksmith and which is applicable both to plain and rough-shod shoes. This patentee has also invented another detachable heel-calk for horseshoes and it relates to detachable heel-calks for horseshoes of that form in which the heels of the shoe are enlarged laterally at the ends. This form of heel is common in shoes of a composite character in which a skeleton iron shoe is imbedded in an elastic rubber mat.

DETACHABLE CALK FOR HORSESHOES.—T. W. J. McGANN, Washington, D. C. In this case the invention has for its object to provide a construction which can be readily applied to the ordinary horseshoe when on the horse's hoof and easily removed and will be efficient for the purpose designed when applied.

Hardware.

LOCK.—N. W. WEBB, New York, N. Y. The improvement pertains to locks and latches for doors and the like; and its object is to provide a lock arranged to prevent unauthorized persons from unlocking the door or other part on which the lock is used, the main bolt of the lock being held against retraction when the door is in a closed position unless the operator has the proper key or can turn the knob on the inside of the door.

SASH-CORD FASTENER.—L. H. BROOME, Jersey City, N. J. One purpose of the improvement is to provide a device adapted for use in connection with a sash cord or chain to produce a knot therein for the purpose of removably securing the cord or chain to the window-sash, said cord or chain being especially adapted for attachment to a weight.

REVERSIBLE HANDLE ATTACHMENT FOR PLANES.—B. HUNTER, Spokane, Wash. In the present patent the invention is an improvement in that class of carpenter's or hand planes which are provided with handles adapted to be shifted laterally, so that the plane may be used in angles or corners where it would be otherwise impracticable.

WRENCH.—M. J. McGINN, Proctor, Minn. This wrench firmly grips a pipe with an equal strain on all parts of the same, thus preventing crushing the pipe by extreme pressure applied at one point only. This is done by fitting an intermediately-pivoted jaw on the end of the lever or handle. To this jaw is joined a chain also joined to the lever and engaging intermediate the ends of the chain with a block, to which a second chain is joined, the jaw being adapted to removably engage said second chain, so that after adjusting parts on the pipe by swinging the lever the first chain exerts tension on the second, forcing same against pipe and gripping it firmly.

SNAP-HOOK. — SAMUEL HOAR, Hibbing, Minn. Mr. Hoar provides a snap hook together with a mousing, in which the hook is mounted and with which it co-operates, the hook being provided with means for causing the same to become automatically engaged with an end of the mousing as the bill of the hook is introduced thereinto to secure in place thereon a bit-ring or other device in connection with which the structure is employed.

PLUMBER'S CLAMP.—R. PARKER, Lakewood, N. J. A base-frame is employed, its duplicate members being collapsible, and associated with each member is a clamp comprising a stationary and a movable member, together with means for operating the latter to lighten a section of pipe in place between the jaws of the two said members. Said clamps are collapsible with reference to each other and duplicate members of said frame. Means rigidly secure members of the frame in distended relation to each other for operation. Means rigidly secure clamps in operative relation with frame, each being provided with means for enabling quick adjustment thereof in accordance with pipes of varying diameters.

WIRE-WORKING DIE.—S. E. JACKSON and E. B. LEE, Weston, Mich. The principal objects of the inventor are to provide means for forming a joint or lock in a vertical position and still have an angle in each of the vertical wires which it connects, therefore making it impossible for the lock to slide up and down. Another of additional objects is to cause the lock-wire to wrap around the line and stay once and then again around the line-wire, with each end of the lock-wire lying against the stay-wire. This assists in preventing sliding of parts upon each other.

Heating and Lighting.

ACETYLENE-GAS GENERATOR.—L. C. GILMORE, San Pedro, Cal. The generator is arranged to insure periodic feeding of the carbid according to the consumption of the generated gas, to permit of agitating the carbid in the water-tank from the outside of the apparatus, to allow feeding of the carbid by hand to purify and cool the generated gas, and to provide a ready escape from the generated gas from the water-tank into the outer air whenever the gas is under excessive pressure.

TRAP.—E. J. RYAN, Danville, Ill. Means are provided whereby the air forced from the radiators by the steam-pressure is allowed to discharge into the atmosphere, and the discharge-pipe sealed to prevent inlet of air, thereby causing a vacuum in the entire apparatus whenever water in the boiler arrives at 212 deg. Creating a vacuum at this time in the apparatus allows water to continue boiling and generates steam under a vacuum, thereby making any steam-heating system a combined pressure and vacuum steam-heating system, and providing a means whereby the water of condensation is trapped and carried back to the boiler or steam-generator.

VACUUM HEATING SYSTEM.—C. A. DUNHAM, Marshalltown, Iowa. The object in this case is to provide improvements in vacuum heating systems whereby a thorough and uniform heating is insured, a partial vacuum may be maintained throughout the system, only one pump is employed for returning the water of condensation directly to the boiler, the use of air-escape valves on radiators or like heating mediums is dispensed with, and the air in water of condensation is separated from the water and is discharged at the pump, which latter is kept primed at all times.

WATER-CIRCULATING APPARATUS. — J. N. RUSSELL, 22 Charing Cross, Whitehall, London, England. The invention relates to water-circulation apparatus such as is used for warming buildings, supplying hot-water draw-off taps, or for cooling storage rooms and the like and wherein the water ascends from the point where it takes up the heat. The object is to overcome a difficulty in this arrangement, and the invention consists in means whereby return water does not return directly to the heater, but is forced up a secondary ascension-pipe (by an aerated column-pump or equivalent) to an elevated tank, whereby a head of water is produced. Water passes from tank to heater by a final return-pipe, accelerating natural circulation.

Household Utilities.

ICE-PITCHER.—J. KRAKAUER, New York, N. Y. The particular object of this invention which relates to ice-pitchers and analogous vessels is to provide the body portion of the vessel with a compartment distinct from that used for holding the fluid contents of the vessel, this compartment being for the purpose of holding ice out of contact with the ordinary contents.

GARBAGE-CAN.—J. R. MOLER, H. E. INSLEE, and S. L. PHILLIPS, Denver, Col. The invention is an improvement in the class of receptacles located upon the street or adjacent to houses for the purposes of receiving and temporarily holding garbage, rubbish, etc. The body of the can is oblong and rectangular in form and constructed of sheet metal, preferably thin galvanized iron, and within is suspended a canvas sack. The bottom of the can being open, air has free access to the sack on all sides, so that material deposited in it is constantly subjected to drying action.

Machines and Mechanical Devices.

FREEZING DEVICE.—E. THOMPSON, New Rochelle, N. Y. This patentee's invention is mainly intended as an ice cream freezer and he provides a can spaced from the case by a coil for the freezing mixture, and forms in the bottom of the can an outlet leading to a chute, the opening being controlled by a slide. The agitator is mounted on a shaft extending through the bottom of the case and can, the shaft being designed to be operated by a drive shaft and gearing. The cream having been frozen the slide is withdrawn and the movement of the agitator serves to discharge the cream through the opening, and chute.

CORRUGATING-MACHINE. — G. B. JOHNSON, 8 Victoria street, Westminster, London, England. This invention relates to a machine for producing a plurality of longitudinally-extending corrugations in a sheet of metal. The object is to enable a machine of this type to be employed for producing shapes comprising a plurality of reverse curves and for bringing sheets of metal of any width to a corrugated cross-sectional form—as is commonly required in roofing-sheets—whether the contour of corrugations be regular and symmetrical or otherwise and whether finished sheets be required to be flat or curved longitudinally.

CARPET-CUTTING MACHINE. — R. E. DUNN and W. A. DUNN, Faribault, Minn. Old carpets and similar articles are cut up into strips and reweaved to form carpets, rugs, and the like. In order to provide a nap for such articles, the strips are slashed on their edges. The operation consumes considerable time, and the regularity of slashing is likely to be neglected when cheap labor is employed. The object of the invention is to provide a machine which will simultaneously cut up old carpets and fabrics of all kinds into longitudinal strips and slash the edges thereof regularly and uniformly.

AUTOMATIC WEIGHING-MACHINE. — E. HANAK, San Francisco, Cal. In the present patent the invention has reference to a machine which is especially adapted to accurately weigh or measure with great rapidity substances such as coffee, tea, seeds, spices and all granular and all powdered substances that will flow by gravitation.

STROPPING-MACHINE. — J. R. CURLEY, New York, N. Y. One purpose of the inventor is to provide a machine by means of which a razor is stropped at the same angle as by hand and every stroke at the same angle and the strop is so shaped as to conform to the shape of the razor edge, insuring the entire edge being stropped the full length of the stroke, thereby enabling it to be stropped in fewer strokes than by hand, wherein the different parts of the blade are stropped but for a small portion of each stroke and no part is stropped the entire length of the stroke unless at the expense of some other part.

RAFTER-SCALE.—W. W. DWIGANS and J. M. ADAMS, Arkadelphia, Ark. In this instance the invention refers to mechanics' tools. The object of the improvement is to provide a convenient plumb-scale for finding the lengths of rafters of various pitches and for different widths of buildings. The device may be used in one way, as an ordinary level to show whether a beam or floor is horizontal.

EQUALIZING WEIGHT-FEED FOR DRILL-SHANKS.—K. BROOKS, New York, N. Y. The purpose of the invention is to provide an adjustable automatic weight or core drill feed for drill-shanks designed to furnish a uniform pressure for what is known as "core-drills" from the commencement to the completion of its work and to provide the device with adjustable weights, which serve to maintain perfect equilibrium.

SEWING-MACHINE STAND.—G. D. COOPER, Providence, R. I. The underlying object of the invention is to improve the ordinary cast-iron stand in point of lightness and durability, permitting the machine to be shipped with less freight rates and liability to breakage and producing a lighter machine, which may be moved about with greater ease than those ordinarily constructed. He constructs the stand of iron rods or heavy wire, the parts of which are joined in a peculiar manner, producing a very light and strong structure at diminished cost.

COMBINED REAMER AND DIE-STOCK.—J. J. DELEHANT, Chicago, Ill. The invention relates to mechanism for threading and reaming pipes, and more particularly to a reamer to be connected with a die-stock in such a manner as to accomplish both the threading and reaming at a single operation. Any ordinary die-stock may be employed in this relation.

DECORTICATING-MACHINE.—M. CASTELLON, Merida, Yucatan, Mexico. One purpose of the inventor is to construct a machine for decorticating the leaves of plants, especially sisal hemp, and to provide a machine which will expeditiously remove the pulp from the fiber in a thorough and cleanly manner and without detriment to the fiber.

ADDING-MACHINE.—N. H. KODAMA and A. I. GANCHER, New York, N. Y. The object of the invention is to provide a machine not liable to easily get out of order, and arranged to permit convenient manipulating with a view to add up any desired number of sums and indicate the total, and more particularly to add sums representing money in dollars and cents and other denominations.

PROPELLING MECHANISM.—F. PELISSIER, Gonaives, Haiti. The invention relates to mechanism for propelling ships. The object of the inventor is to provide mechanism which will be positive in its action and which will facilitate the steering of a ship as well as its propulsion. Further, to provide an arrangement whereby the propelling mechanism may be readily attached to ships previously completed.

ATTACHMENT FOR CARTON-MAKING MACHINES.—R. SUNDERMAN, Buffalo, N. Y. The present invention embodies several objects, one of which is to slightly open the carton-blank immediately after the same is fed into the machine—that is, where carton-blanks are fed into a machine for the purpose of being formed into complete cartons, and especially where they are to be filled—while in the same machine it is desirable that some means be provided for opening the carton-blanks. It is of peculiar service in connection with carton-making machines described in Mr. Sunderman's pending application previously filed.

UNIVERSAL ADJUSTER FOR PRINTING-FILMS.—R. DAY, West Hoboken, N. J. In the present patent the invention relates to the manipulation of printing-films, one of which is inclosed in an appropriate frame, Mr. Day's more particular object being to secure precision in the handling of the film relatively to the work. It further relates to certain means for adjusting the frame so as to bring it to a predetermined part of the work and for turning the frame and the work to different angles relatively to each other for the purpose of producing various changes in shading.

CUTTING ATTACHMENT FOR PRINTING-PRESSES.—J. W. SMITH and G. U. HAHN, Jr., Columbus, Ohio. One purpose here is to provide a knife so mounted with reference to the frame of the machine and with relation to the feed for the paper that as the knife and its support approach the cutting position of the knife said parts are automatically fed forward by suitable mechanism at the same rate of speed as that at which the paper travels, thereby insuring a clean cut when the knife is actually in cutting action without danger of buckling the paper. The invention relates to an improvement on the press for which Letters Patent were formerly granted to the above inventors.

COIN-CONTROLLED APPARATUS.—M. F. PRICE, Iowa City, Iowa. The present invention is an improvement over mechanism of Mr. Price's prior patent. In the prior device two stops are employed, the bottom stop working against the lowermost button of a superimposed pile and the upper stop working between the lowermost button and one next adjacent, the stops operating alternately separately to deliver the buttons. The main object of the present improvement is to render the operation of these stops wholly automatic upon the insertion of a proper coin.

BARBER'S APPLIANCE. — G. W. HALE, Norfolk, Va. The aim of this invention is to construct a device for barber's use particularly adapted for shampooing, massaging, and removing loose hair, dust, and dandruff from the head, and furthermore, for invigorating the scalp. The device can be operated manually or from a source of power.

CUTTING-MACHINE. — W. C. QUINLAN, Barre, Vt. In this case the invention relates to stone-cutting, and the object is to provide a new and improved cutting-machine for surfacing or other work and arranged to remove a large amount of stock in a comparatively short time and without unduly heating the cutters or subjecting the same to injurious strains. The machine is designed for cutting both backward and forward with a cross belt. It can accommodate a large number of tools.

MECHANISM FOR CONVERTING ROTARY MOTION INTO RECIPROCATORY MOTION.—L. NEUMANN, Gleiwitz, Prussia, Germany. The invention relates to improvements in that kind of mechanism for converting motion in which a reciprocating ring is mounted between two inclined rotary disks. The object is to adapt such mechanism for a greater variety of purposes, and quite particularly to enable it to be used for converting reciprocating into a rotary motion, which was not heretofore possible. Such mechanism comprises two curved or angular disks or the like arranged parallel to each other, but inclined with regard to their axes of rotation and between which an annular part is guided so that during rotary movement of disks the said part is revolved and caused to oscillate in longitudinal direction of the axis.

VENDING DEVICE.—S. C. GILBERT, Jackson, Ohio. Means are provided for holding a series of bags of peanuts or other similar ar

ticles in a casing and automatically delivering one bag at a time upon manipulation of any desired starting device—such, for instance, as coin-controlled mechanism; also means for preventing the delivery of more than one package at each operation of the controlling device and for heating the packages, to keep the contents warm at all times.

FEEDER FOR SUGAR-CANE CARRIERS.—L. M. Dill, Avoca, La. The purpose of this inventor is to provide a simple and economic machine especially adapted for raking cane from a car upon the carrier which conducts it to the sugar-mill and to so construct the machine that the operator can cause the rake to move forward or backward or be raised or lowered at will.

TRAP.—W. E. Weed, Deer Lodge, Mont. The object of the improvement is to provide details of construction enabling convenient and safe setting of the trap, its easy and rapid release from a captive, which avoids liability of maiming the animal or bird caught, and which enables a person accidentally caught to easily release himself without suffering injury to the member held therein.

MEAT ROLLER OR WRINGER.—B. L. Packard, Denver, Col. The object of this invention is to provide an improved device in which means is provided for regulating the pressure applied to meat when passing through the device and in which means is also provided to permit the separation of the pressure rollers to allow bones to pass between them without crushing and splintering.

Prime Movers and Their Accessories.

CARBURETER FOR EXPLOSIVE-ENGINES.—J. H. Johnston, 145 Rue de la Pompe, Paris, France. In this patent the invention has reference to a carbureter for explosive-engines so equipped as to allow of obtaining an explosive mixture the richness of which will always remain the same whatever may be the speed of the engine. In this case the richness depends on the speed at which the air passes around the orifice of the spray-pipe.

HEAT-SCREEN FOR STEAM-CHESTS.—D. C. Bailly, Real, Minn. The object of the invention is to prevent the condensation of steam in steam-chests, due in part to the reduction in pressure in passing from the governor to the steam-chest and the consequent loss of heat and to the further loss of heat due to the radiation from the steam-chest covering. The invention is intended to prevent this radiation.

LIFT-PUMP.—H. M. Crow, Oakdale, Cal. The aim of this invention is to provide a pump which may be driven by means of an engine or similar motive power, but which is adapted to be altered readily, so as to enable the well-rod to be attached to the rod of a windmill. It is especially useful in localities where windmills are used for raising water, but which cannot be depended upon under all weather conditions.

Railways and Their Accessories.

LATCH DEVICE FOR DUMPING STRUCTURES.—C. F. Shelby, Globe, Ariz. Ter. The purpose of the inventor is to provide a latch device especially designed for normally holding the dumping or rocking body of a car in carrying position on the platform and to so construct the latch that it is simple, durable, economic, and readily applied. It can be quickly and conveniently disconnected from its keeper when the body of the car is brought to its normal or carrying position.

SPIKE-PULLER.—T. W. Harner, Dudenville, Mo. One purpose of the improvement is to provide a device for pulling spikes used in connection with railway-rails or bolts or common nails, even though said articles be headless, and to so construct it that the jaws may be adjusted to close properly on the articles to be drawn, and so that as it is applied the jaws automatically open and then close as the device is put in withdrawing action, tightening their grip correspondingly to the applied withdrawal force.

RAILWAY-SWITCH.—A. A. Shaw, Arkadelphia, Ark. The object in this case is to provide a compact and efficient switch-frog with a view of obtaining a convex track-rail both for the main line and switch or siding, and that will be adapted to all kinds of switching whether the switch is operated from a switch-station or a tower. It embodies all the essential features of a safe and reliable switch frog, yet is simple in construction, having no complicated mechanism to break or get out of working order, thus insuring reliable action at all times, with cost of manufacture reduced to the minimum.

CAR-COUPLING.—F. Keller, Allentown, and D. Bowman, Emaus, Pa. The coupling comprises coupling-heads practically duplicates of each other and constructed interiorly to contain and permit of the working organization of the inner operative devices of the head. A locking-block is used in each coupling-head, combined with which are devices for securely holding same in operative position both when the two heads are in coupled or uncoupled relation, further devices being employed for setting and securing the locking-block in rearward position within the head to enable either one of the coupled cars to be disconnected from the other without the presence of an operator. Action of locking-block of each coupling-head is automatic.

RAILWAY SPIKE AND TIE-PLATE.—T. G. Peterman, Cumberland, Md. The invention relates to improvements in spikes and tie-plates for railway-rails, the object being to provide a spike so constructed as not only to firmly hold the rail, but effectually to prevent the passing of water down the spike to the tie, thus preventing rotting of the wooden tie at this point and consequent loosening of the spike.

RAILROAD-TIE.—J. F. Bailey, Valdosta, Ga. The tie may be formed of a single plate and afterward divided or may be formed of two plates, and a block of wood is made of larger size than the pocket and driven thereinto, thus providing a firm hold for the spike. When the flanges are embedded in the ballast, the tie is restrained both from transverse and from longitudinal movement with respect to road-bed, and by provision of a hinge a tie is formed free from the objections found in the ordinary metallic tie—that is, lack of resiliency. It is resilient and flexible, yet not sufficient to impair alinement of the rails.

CAR-COUPLING.—F. A. Ramey, Woodstock, Va. By this improvement the inventor seeks to provide an oscillating draw-head section and devices for holding the coupling-knuckle in locked position when said section is in normal position and for releasing the locking devices for said knuckle when the oscillating section is moved laterally in either direction out of its normal position.

ANTICREEPER.—C. Lien, Salt Lake City, Utah. The principal object of the invention is not only to check the longitudinally creeping tendency of rails, but also to prevent it entirely. With this and other objects in view the invention comprises a clamp to be secured to the rail and a fastening device for the clamp adapted to engage with a sleeper on the road-bed to prevent movement of the rail transverse to the sleeper.

CAR-COUPLING.—B. J. Cobb, Leesville, La. A coupling is employed of the ordinary link-and-pin type, comprising coupling members, each practically a duplicate of the other. A specially-constructed coupling member is employed for each of the two cars to be coupled together, associated with which is an ordinary coupling-link, together with a specially-constructed pin-fastening therefor, coöperating with which is a controlling-block of special construction located and operated interiorly of the coupled member.

SIGNAL SYSTEM.—J. H. Lynch, Red Bank, N. J. Principal objects of this invention are to provide means whereby the passage of a train over a certain part of the road can be caused to set signals in the rear for the observation of the crew of any train approaching from behind, and further, to provide means whereby the setting of these signals will not only permit the crew to understand the position of train in advance, but to automatically stop the approaching train.

Pertaining to Recreation.

GAME-CARDS.—C. Warne, Asbury Park, N. J. In the present patent the invention has reference to new and useful improvements in game-cards; and it has for its object to provide a pack of playing-cards with which certain interesting and instructive games may be played. The rules permit of two, four handed, and other styles of games.

Pertaining to Vehicles.

TRUCK.—D. H. Rowe, Oakland, Cal. The object in this case is to provide a truck which will be capable of carrying baggage and freight with the same facility as such loads are carried by the ordinary trucks, but which, in addition, shall be so constructed as to enable a heavy load to be taken up and down a flight of stairs.

VEHICLE-WHEEL.—R. F. Martindale, Memphis, Tenn. More particularly the invention relates to such vehicle-wheels as are portions of draft-wagon running-gears. The object is to provide a wheel very light, durable, and exceedingly strong, well adapted for convenient repair, and not liable to become clogged with clay or the like when the wagon is traversing muddy roads. It is manufactured of metal, and largely from plated metal cut and stamped into form, whereby it is adapted for rapid and perfect production at a low cost.

MOTOR-VEHICLE RUNNING-GEAR.—R. B. Vaughn, Kingston, Pa. The leading object of the invention is to so construct the running-gear and frame of a motor-car or other automobile-vehicle as to dispense wholly or in part with the necessity for pneumatic or other cushion tires on the road-wheels. It is also an object of invention to mount the frame and body so as to permit easy and free movement on the springs, preventing, however, violent and erratic movement.

TIRE.—J. C. Raymond, New York, N. Y. In operation the parts, a circumferential cushion, a tire-frame, and a base plate are assembled. The frame holds the casing, the cushion, and the inner tube and the plate is applied to secure the casing in engagement with the frame and to form a carrier for the parts ready for application to the frame of the wheel. The plate, with the tire in place, can now be slipped laterally over a rim-plate and screws applied to secure the parts in place.

Wearing Apparel.

HAIR-PIN.—G. H. Bigelow, San Francisco, Cal. The purpose in this case is to provide a pin that will be effective to support the hair, will not accidentally slip from place, and is provided with means for readily and quickly removing the pin from the hair, the handle means being so disposed as to secure an arrangement of the legs of the pin in different planes, so one may readily slide back of the other in pressing the pin into the hair and in removing the pin.

COMBINED UNDERGARMENT AND TESTES-SUPPORTER.—W. C. A. Bullock, Jackson, Miss. In the present improvement the object of the inventor is the provision of an undergarment for a man with novel features of construction that coact with supporting-bands for the comfortable support of the scrotum and testes when such treatment is found necessary.

Designs.

DESIGN FOR A PLATE OR SIMILAR DISH.—A. S. Higgins, New York, N. Y. A design patent has been granted to Mr. Higgins for a plate. It is round and the width from the central depression to the outer edge is broadly wreathed by beautiful clover blossoms and fern leaves. An ornamental circle in the center of the dish surrounds the head and neck of a cow.

DESIGN FOR A WOODEN MUG.—R. P. Spooner, Cornwall-on-the-Hudson, N. Y. In this case the mug which is somewhat high for its width is designed with a rustic body, slightly and gracefully widening to the bottom. A rustic handle is inserted at the wooden bands encircling the mug.

DESIGN FOR KNIT FABRIC.—C. H. French, Canton, Mass. This ornamental design comprises a field of fabric alternating with comparatively light and heavy bands. The light bands are the narrowest and quite plain, while the heavier and broader ones are reinforced by clusters of irregular and unpatterned forms. Mr. French has also designed another knit fabric wherein the bands are relatively wider and narrower. The darker and broader have the appearance of ragged and indefinite transverse stripes. The narrow bands are plain.

DESIGN FOR A COOKING-STOVE.—E. C. Cole, Chicago, Ill. This design includes a round fire pot and stove body and a rectangular oven mounted upon suitable supports above the body, the supports being mounted upon the top, the latter being provided with suitable lids and key plates, and the whole presenting an attractive appearance.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 8043.—Wanted, address of Paris or United States manufacturer of reconstructed rubies and emeralds

For logging engines. J. S. Mundy, Newark, N. J.

Inquiry No. 8044.—Wanted, address of manufacturer of Cast show case.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 8045.—For manufacturers of fine quality sewing needles.

Handle & Spoke Mchy. Ober Mfg. Co., 19 Bell St., Chagrin Falls, O.

Inquiry No. 8046.—Wanted, address of ivory-carving machine manufacturers.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 8047.—For manufacturers of tinfoil rolling mills for foil in endless lengths.

Wanted.—Patents on bed spring constructions. Mebane Bedding Co., Mebane, N. C.

Inquiry No. 8048.—For manufacturers of machine used in vacuum closed jars.

For Sale.—Patent No. 774,043. Self-reversing trolley pole. W. R. Cooper, 640 Morton Ave., Greencastle, Ind.

Inquiry No. 8049.—For manufacturers of 20th Century Gyroscope, also manufacturers of novelties and specialties.

Well rotten up typewritten letters will increase your business. $2 per 1,000. Typewritten Letter Co., St. Louis.

Inquiry No. 8050.—Wanted, address of dealer that sells a machine to cut noodles.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company Foot of East 138th Street, New York.

Inquiry No. 8051.—For manufacturers of preparation called "Coal Span," which is a powder designed to sprinkle over coal and thus increase the heat given out.

I have for sale the U. S. and all foreign rights of new patent Improvements in Water Tube Types of Boilers. Great economizer. J. M. Colman, Everett, Wash.

Inquiry No. 8052.—For manufacturers of malleable iron thumb screws.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8053.—For manufacturers of skees.

Inquiry No. 8054.—Wanted, address of dealers in Jupiter wire cables of small size.

Inquiry No. 8055.—Wanted, address of firms installing alcohol lighting plants.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9944) P. J. L. asks how to make tracing cloth. A. 1. Boiled linseed oil (bleached), 10 pounds; lead shavings, ½ pound; zinc oxide, 2½ pounds; Venetian turpentine, ¼ pound. Boil for several hours, then strain, and dissolve in the strained composition 2½ pounds white gum copal. Remove from the fire, and when partly cold, add oil of turpentine (purified), sufficient to bring it to proper consistence. Moisten the cloth thoroughly in benzole and give it a flowing coat of varnish. 2. Varnish the cloth with Canada balsam dissolved in turpentine, to which may be added a few drops of castor oil, but do not add too much, or it will not dry. Try a little piece first with a small quantity of varnish. The kind of cloth to use is fine linen; don't let the varnish be too thick.

(9945) G. O. W. says: I want to build a stereopticon using a 7-inch Mangin mirror, an acetylene illuminant of six or eight 2-foot burners giving 100 candle-power each, bunching the burners together as much as possible. I want to use condensing lenses 7-inch diameter, 12-inch focus, and a two-third size achromatic projecting lens whose equivalent focus is 12 inches. A. We would say in reference to your inquiries regarding the arrangement of lenses, light, and mirror for a stereopticon, that all such instruments are made adjustable, so that the various distances may be altered to adapt the projection to halls of different lengths. You can determine the proper position for each by trial, and make the parts of the apparatus to correspond. It is not possible from the data you give to make any reliable calculations for the various positions. You say "a 7-inch Mangin mirror." If this means the focal length, then 7 inches is the proper distance for the center of the light. If it is the diameter of the mirror, it does not give any information upon the subject. Proceed as follows: In a darkened room place a candle flame, so that the reflected light emerges as nearly parallel as possible, or so that the beam can all of it enter your 7-inch condenser, and come to a focus after it passes the condenser at such a distance from the condenser as to allow the two-thirds lens to take in most or all of the light. These directions are the best we can do, and give the method we use in the same case. 2. How far the center of the flame must be from the mirror? A. The place for the flame of a stereopticon is a short distance beyond the focus for parallel rays. You can find this focus by placing the mirror in the sunlight and measuring the focal length—the distance from the center of the mirror to the focus of the sun's rays. 3. How far the mirror must be from the condensing lens nearest the mirror? A. The mirror should be at such a distance from the condenser that the beam from the mirror may enter the condenser. Find by experiment. 4. Which would be more satisfactory—to place the flames so that they cover the mirror reflector, or place them in line with the axis of the mirror? The Mangin mirror is concave, so as to throw the rays of light parallel. A. Acetylene flames are usually placed in a straight line in the axis of the lenses. We have never seen more than four used. Seven would make too long a line of flame. Perhaps with so large a mirror and lens the lights might be staggered to advantage. 5. Would it interfere with the intensity of the light to place a thin glass over the mirror, so as to protect it from the heat to prevent breaking the same? A. A thin glass or a sheet of mica is frequently used to protect the condensers from the heat of the calcium light. You can use such an arrangement. 6. The condensing lenses are placed so that their convex sides are together. How far apart ought they to be, measuring from the surface of one at the center to the surface of the other at the center? A. The lenses of a condenser are placed with their convex surfaces toward each other, and as close to each other as they can be without touching each other. Distance not important further than this. 7. How far from the plane surface of the condensing lens nearest the objective to the center of the two-thirds size objective? A. The distance of the objective from the condenser depends upon the distance of the screen from the lantern, or the length of the hall in which the lantern is used. The objective

must be movable, since a thick slide may require an adjustment of the objective to make it sharp after it has been thrown upon the screen.

(9946) H. H. H. asks: 1. In central station telephone exchange work, where they have party lines with as many as four 'phones connected with the switchboard with only two wires, how is the operator enabled to ring any one of the 'phones she wishes without disturbing the others? I understand they use an alternating current for ringing, and that the 'phones are all alike in construction, that any one of them could be used in place of any other one, that is, they are interchangeable, provided that the connections in the instrument are properly changed. Is this right? Of about what potential is the current that is ordinarily used to actuate the ringer movements? A. The methods for selective calling upon party lines of telephones are divided by Miller into three classes: 1. Those employing step-by-step movements for completing the calling circuit. 2. Those employing currents of different directions or polarity. 3. Those employing currents of different frequencies for actuating the different signals, a harmonic system. These several methods are fully discussed and described for 37 pages in Miller's "American Telephone Practice," which we send for $4, to which we would refer you for further information. 2. In winding the armature of a D. C. shunt motor, to carry a current of say ten amperes, is it necessary to select a size of wire that will carry ten amperes without heating, or is one of a five-ampere capacity large enough? Does not the current, on entering the armature, separate, and flow half around one way, and half the other? And how does the rule apply in the case of a dynamo? A. In a direct-current motor armature as ordinarily wound and connected, the current divides at one brush and goes in opposite directions, uniting at the opposite side at the other brush. Each side carries but half the current, and thus need be wound with wire of a size suitable for half the current. 3. Can you give directions for recharging a battery of dry cells with a dynamo? About how many amperes would you force through, and for how long? Is the voltage of the charging current an essential factor? A. We have had no experience in recharging dry cells with a dynamo or otherwise, and do not think the game is worth the candle. The voltage of the charging current should be about 2 volts per cell in series.

(9947) S. G. B. asks: (1) What strength approximately is required to break an egg held end to end between the palms of the hands, and why the resistance? (2) Can any living man perform this feat, i. e., is any man strong enough? I enclose stamp for reply, although probably you answer no inquiries except through the columns of your paper. A. We have never seen any test of the pressure necessary to crush an egg shell in the direction of its longer axis. It is not probably very great. Any one trying this with his hands is a little uncertain of the result and does not really press so very hard. Doubtless many men can press hard enough to crush the simple arch of the shell. The force required can easily enough be determined by making a plaster cast to fit the two ends of the egg, and then applying pressure till the shell gives way. We answer many more questions by mail than through our columns. Only those thought to be of general interest are printed.

(9948) S. G. B. asks: In your reply March 1 to a question of mine relative to the strength of an egg in the direction of its longer axis you say that probably the resistance is not very great and that many men can doubtless crush an egg held end to end between the hands. With a plaster cast fitting the ends of an egg I applied pressure until the shell gave way. It bore a resistance of 74 pounds. When 7 or 8 pounds more were added the shell gave way. It is very difficult to balance the pressure satisfactorily, consequently I think that an egg offers a resistance of more than 74 to 80 pounds. My theory is that a resistance of 15 pounds per square inch (atmospheric pressure) must be overcome before there is any strain whatever on the egg-shell. An egg probably has from 7 to 10 square inches of surface. Multiplied by 15 this would give a resistance of 100 to 150 pounds. Few men have such strength. Many strong men, local champions, have tried this experiment of breaking an egg between the palms of the hands and failed. A. Your observation of the breaking strength of an egg-shell under direct and equally distributed pressure is very interesting. The figure you give does not seem very large, and is probably quite near correct. We cannot agree with you that the pressure of the air resists the breaking of the shell, since that pressure is upon the outside of the shell all the time, and is balanced by a pressure from within just as it is upon our own bodies. It has no influence either way upon the power required to break the shell.

(9949) A. G. H. asks how to mend tortoise shell. A. Small pieces of good tortoise shell may be joined so as to form one large apparently seamless piece in the following manner: Slope off the margins of the shells for a distance of about ¼ of an inch from the edge. Then place them so that the margins overlap one another; and thus arranged put them in an iron press and immerse in boiling water for some time. The pieces by this means become so perfectly united that the joint cannot be seen. The filings and very small scraps may be softened in hot water and consolidated by hydraulic pressure in metal molds. Protracted heating of tortoise shell darkens it, and greatly lessens its beauty.

(9950) T. K. asks: 1. Will you kindly explain, in your notes and queries, the mechanism and working of a wattmeter? A. Wattmeters are instruments which have two coils, one a fixed coil of coarse wire in which the current is proportional to the amperes, and the other a movable coil of fine wire in which the flow is proportional to the volts. The instrument is an electro dynamometer; the flow in the coarse coil produces a magnetic field varying with the current in amperes, and the swing or rotation of the movable coils is made to act upon the index or motion of the indexes upon the dials according to the product of the intensities, of volts and amperes, or watts. 2. How does the feeding and regulating mechanism of an arc light act? A. Most of the arc lamps regulate the feed of the upper carbon by means of a clutch. When the arc becomes too long the current through the arc is reduced, and the current through the shunt circuit which controls the clutch becomes greater, and the clutch releases the upper carbon, which drops a little. Its sliding is stopped by the increase of the current in the arc and the decrease of current in the shunt.

(9951) A. L. R. asks how to make fire-proof roofing. A. After the paper is put on take coal tar and lime (burnt, but not slaked), and boil them together in the proportion of 15 pounds lime to 100 pounds tar. Put it on hot. To pulverize the lime, sprinkle it with a little water and sift it. To avoid the tar boiling over, stir the lime in the boiling tar very slowly. The mixture must always be heated before putting on. The lime and tar form a chemical connection, which is fire proof, cannot be melted by sun heat or dissolved by steam or hot water, and makes a smooth, glazed roof.

(9952) M. C. writes: Referring to inquiry 9916, p. 238, my observation is: On inland lakes, where the ice often melts without wind to disturb it, the surface of the lake will appear to have a quite solid covering of ice, and often will sustain a man's weight after a frosty night, and all disappear in a few hours, which gives the impression that it sinks. In reality, ice in thawing becomes very porous, and if disturbed will fall into "nails," as often described. This may be seen in a block of ice lying in the sunshine a short time. Ice in this condition may be a foot or more in thickness, but a slight disturbance will cause it to fall into the small pieces and dissolve in a few minutes. Persons not noticing carefully think it sinks, which of course is impossible. A. The reason given above for the disappearance of ice on a pond in the spring is doubtless the true one, but the question put to us was as to the origin of the belief that the ice sinks when it disappears. This we cannot give. We should have accounted for the disappearance of the ice as our correspondent does, but this does not explain the belief of some intelligent people that the ice sinks when it disappears. That is evidently another matter. We answered the question which was put to us by our correspondent.

(9953) V. R. K. asks: I would be pleased to have you inform me if there is anything that could be put in water to stop it from freezing. I have used salt, but find that it freezes after it gets a certain amount of cold. It must not contain spirits, so as when heated to cause an explosive gas; it must also flow freely. What action has salt on water against cold? A. Calcium chloride brine, such as is used in cold storage houses for refrigeration, will be what you require. Put 3 to 5 pounds of calcium chloride to the gallon of water, and its freezing point will be reduced to 39 deg. below zero Fahr. Salt and water will freeze at a little below zero. The melting point of a mixture of salt and ice is 7.6 deg. below zero Fahr. Below this temperature the salt and ice are solid; above that point the mixture is liquid. That temperature is its melting point, just as ice has a melting point of 32 deg. Fahr.

(9954) R. G. H. asks: In answer No. 9915, page 238, you say the months "beginning with January," etc. I have read that the old year began March 1. I understand that September (7th), October (8th), etc., were so called when the year began March 1, and when the change was made the names were left. If that is correct, should you not have said, "beginning with March"? A. Our use of the phrase "beginning with January" had no reference to the beginning of the year now or at any other time. It happens that the year as ordered by Julius Cæsar began January 1, in order to bring the vernal equinox on the 25th of March as it had been in the time of Numa. This was the 46th year before the birth of Christ. We were asked to explain the number of days in the months, and kept strictly to the question asked. The beginning of the year on January 1 was instituted by England in 1752. Before this time the year had begun on March 25. Scotland had made the change in 1600, and France in 1563. It is not correct so far as the Julian calendar goes to say that March is the first month. The changes in the length of months dates from the Cæsars—Julius and Augustus.

NEW BOOKS, ETC.

BEER BOTTLERS' HANDY BOOK. By Philip Dreesbach. Wahl-Henius Institute, 1906. 12mo.; pp. 765. Price, $5.

This elaborate book is partially based upon the lectures delivered at the Wahl-Henius Institute of Fermentology, and it is intended to serve as a practical volume to meet the many problems apt to confront practical beer bottlers. The author goes very thoroughly not only into the immediate subject embraced in the title, but in a general way as well into the science of brewing with its many subdivisions. Besides this the business phase of the industry is discussed in separate chapters by competent writers. Even many details of work bearing on the brewing industry, which are usually performed by outside contractors, have been included in the book, and in general we may say that it is probably the most comprehensive work of its kind that has so far been placed before the public.

GRAINING, ANCIENT AND MODERN. By William E. Wall. Somerville, Mass.: Published by the Author, 1905. 12mo.; pp. 137; 50 illustrations. Price, $3.

The subject under discussion is unquestionably one of the most important phases of modern house painting and decorating, and the author has handled this in as comprehensive a manner as the importance warrants. The book is splendidly illustrated by full page cuts, showing the various grainings of woods in color, and it will prove of the greatest value to members of the trade. The author's experience in work of this character has fitted him to choose the most necessary matters for discussion, and to eliminate such as have no practical value for the practical man. Not only is the actual work of the graining fully explained and elaborated, but the mechanical side of the trade, the necessary paints, tools, brushes, etc., is also discussed.

MODERN DYNAMOS AND BATTERIES FOR AMATEURS AND STUDENTS. By S. R. Bottone. London: Guilbert Pitman, 1906. 12mo.; pp. 172. Price, $1.

This is the second volume of Electrical Engineering for Students, and in it the author has treated, in a simple and accurate manner, of the construction of many useful appliances required in practical work with current or dynamic electricity. Nearly all the apparatus and machines described can be made by any one possessed of a little perseverance, with the tools usually found at home. The book contains full constructional details and working drawings for making dynamos, motors, battery cells, measuring instruments, and other accessories. A carefully selected list of questions will enable the student to test his knowledge at any time.

THE UNITED-OTTO SYSTEM OF BY-PRODUCT COKE OVENS. New York: The United Coke and Gas Company, 1906. Quarto; cloth; pp. 146; 65 illustrations.

It not infrequently transpires that among the best contributions to scientific literature are the publications of certain of the great manufacturing, engineering, or industrial companies, publications which, while often produced for advertising purposes rather than for the propagation of knowledge, are nevertheless capable of use as reference or text books of the greatest value, and this work unquestionably must be included in the latter category. The book affords general information concerning the by-products coke oven and its operation; and as it is intended primarily for those not familiar with the subject, it avoids to a large extent all unnecessary details of a purely theoretical and technical character. The subject is handled in a most thorough manner, while the language is clear and concise. Among other subdivisions are included chapters on coal, types of ovens, retorts, products, by-products and their use and general arrangement of plants. The book is splendidly illustrated with many engravings, charts, and tables, and is a beautiful example of the printer's art.

PRACTICAL PATTERN MAKING. Edited by Paul N. Hasluck. Philadelphia: David McKay, 1905. 12mo.; pp. 160; 300 diagrams. Price, $1.

This book contains in a convenient form for every-day use a comprehensive digest of information given by experienced craftsmen, and which has previously been published in the Journal Work. The book goes thoroughly into the construction of foundry patterns, core boxes, and patterns and molds for iron columns. Other patterns which are discussed are those for steam engine cylinders, worm wheels, lathe beds, headstocks, poppets, and slide rests. Miscellaneous patterns and core boxes are also described, and the book has three chapters on the jointing and finishing of patterns, and the making of those of circular form. The construction of core boxes and the coring of holes in castings is also discussed.

FOOD AND DIET IN HEALTH AND DISEASE. By Robert F. Williams, M.A., M.D. Philadelphia: Lea Brothers & Co., 1906. 12mo.; pp. 392. Price, $2.

The section of the book devoted to "Food in Health" is interesting as being based upon the work of the Experiment Stations of the United States Department of Agriculture. Digestive processes, physiology, cooking, etc., are admirably treated. The portion devoted to "Food in Disease" takes up the subject of diet in a thorough manner. The book will prove of use to the doctor, the nurse, and the layman.

VALVE GEARS FOR STEAM ENGINES. By Cecil H. Peabody. New York: John Wiley & Sons, 1906. 8vo.; pp. 143; 33 folding plates. Price, $2.50.

There can be little question that there is no feature of steam-engine design of greater importance than the valve and the valve gearing. There are many valuable works on this phase of mechanical engineering, which treat the subject thoroughly from a scientific as well as a practical standpoint. Among the latest publications is the second edition of this book by Prof. Peabody, and it undoubtedly is one of the best contributions to steam engine design. The work is intended to give engineering students instruction in the theory as well as the practice of designing valve gears. As the vast number of valves and gears proposed and in use at the present time would make an exhaustive treatment in a textbook rather difficult, the author's aim appears to be rather to give the learner a firm grasp of the principles and some facility in their application. Graphical methods are used throughout, both for demonstration of principles and for design of gear. In an appendix analytical demonstrations are given of certain principles that cannot be treated in a complete and satisfactory manner by instruction alone. Common and well-known methods and processes have been used in most cases, though certain features are doubtless original. The changes that have been made from the earlier edition have tended to make the book more simple and more easily understood, and the transfer of all analytical work to an appendix has tended to avoid discontinuity in the graphical presentation of the subject.

DAS VERZINNEN, VERZINKEN. By Friedrich Hartmann. Vienna: A. Hartleben's Verlag, 1906. 12mo.; 6 illustrations; pp. 228. Price, 75 cents.

The covering of one metal with a thin layer of another is of such importance to-day, not only for the usual industrial purposes, but for scientific, chemical, and electrical uses as well, that a practical and thorough handbook on this subject is doubtless of value. Recent years have produced in metallurgy countless improvements and innovations, and this also holds true in that phase of the subject discussed by the author. In this, the fifth edition of his work, he has brought it as nearly as possible up to date, and includes therein the best European practice and methods. Considerable space is given to the discussion of the alloy known as magnalium, a mixture of aluminium and magnesium, and which possesses many remarkable characteristics as yet little known among technical men. Electro-metallurgical methods are also thoroughly discussed and developed.

AMERICAN MEN OF SCIENCE. A Biographical Directory. Edited by J. McKeen Cattell. New York: The Science Press, 1906. Large 8vo.; pp. 464.

This book is doubtless a valuable contribution to the organization of science in America. It includes, probably for the first time, a fairly complete survey of the scientific activity of a country at a given period. As a reference book for the field it covers, it may be even more useful in academic circles than "Who's Who in America." Unfortunately, there scarcely exists among scientific men the recognition of common interests and the spirit of co-operation which would help to give science the place it should have in the community, and it is hoped that this work will be of service in making scientific men better acquainted with one another and with one another's work. As far as possible each name is followed by a short historical account, which includes the usual biographical data of birth, residence, etc., as well as the best-known work and the chief field of endeavor.

GLUE, GELATINE, AND THEIR ALLIED PRODUCTS. By Thomas Lambert. London: Charles Griffin & Co.; Philadelphia, 1905. 12mo.; pp. 151. Price, $1.75.

The glue and gelatine industry has made an immense advance during the last few years. Old methods of working have given way to new, and this changed condition of things, due to a better scientific knowledge of the raw materials and their treatment, necessitates a revision of the literature. The work before us is a good one and deals with the subject from a most practical standpoint.

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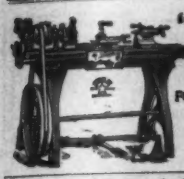

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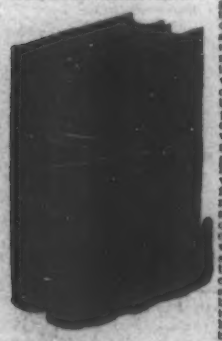

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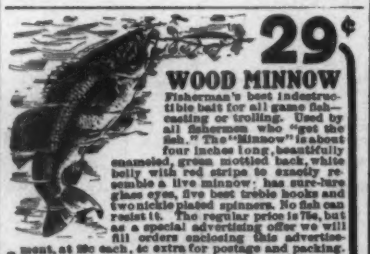

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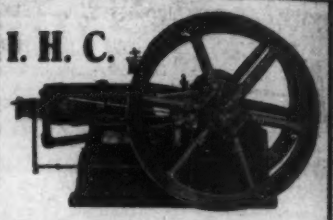

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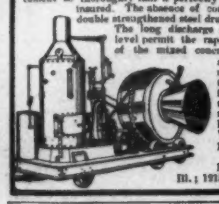

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A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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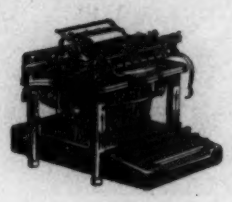

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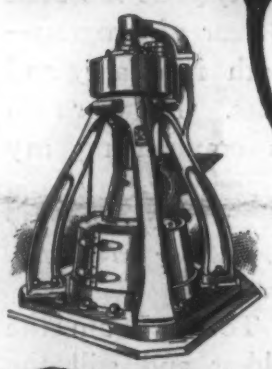

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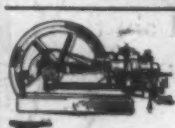

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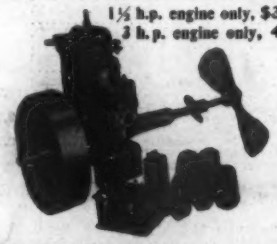

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